

CHAPTER FOUR - ENVIRONMENTAL CONSEQUENCES

Chapter Four discusses the analytical basis for the alternative comparison shown in Chapter Two. The primary focus of this chapter is the effects on the issues described in Chapter One. This chapter also includes discussions about other effects.

SOIL PRODUCTIVITY

Road development and use, pit development, and ore storage may disturb ultramafic soils and lead to reduced soil productivity. The effects are expected to be localized, and would not extend beyond directly disturbed areas. Reclamation objectives emphasize minimum disturbance; Alternatives 6 through 11 would include specific guidance to minimize loss of soil productivity. Concurrent reclamation (stabilizing and vegetating disturbed areas annually) and keeping equipment to specified areas would help minimize soil disturbance.

Soils at the mine sites themselves, as well as in the vicinity of developed roads, will likely become less productive from surface disturbance and compaction, sub-soil exposure, displacement of organics, loss of soil structure, and mixing of soil horizons. Disturbed sites in the area do not revegetate quickly and are visible for many years following disturbance.²⁸

Figure 16 displays the amount of disturbance by alternative. Most of the road system and mine sites have been previously disturbed. Disturbance associated with this proposal would 'set back' any recovery that is already occurring these sites. The loss of soil productivity increases with miles of road and acres of mine pit development.

	PA	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Miles Haul Route	14.3	15.5	15.4	13.3	0	14.3	9.6
Acres of Pit Development	35	35	35	33	0.5	20	20
Total Disturbed Acres (Haul Route Pits and Stockpile)	83	87	87	73	10.5	85	58

Figure 16. Soil Disturbance by Alternatives

Cumulative Effects

At least 512 acres of nickel-bearing laterite occur in the watershed, and would likely be mined given a successful operation. There are about 250,000 acres of ultramafic soils across the Josephine Peridotite Sheet (Hotz 1964- see reference in physical science report). Thus, even continued mining would be unlikely to affect overall soil conditions across the sheet. Several miles of road also currently exist, and many sites have been previously disturbed within the analysis area. The Mendenhall Fire resulted in 8,000 acres of burned area and nearly 5 miles of bulldozed fireline near the project area. The fire area is currently in a recovery mode with little human interference.

²⁸Roads that have not been maintained are evident on aerial photographs. Observations of disturbed areas reveal that revegetation rates vary and are often slow.

SLOPE STABILITY and EROSION

The public has raised numerous concerns about whether the mining pits will be stable or whether they will cause erosion. Mine Site D is on a steeper slope, associated with a higher risk of failure. Road construction is associated with risk of erosion and sediment delivery to streams.

Slope Stability

The mined pits are expected to remain as topographic depressions²⁹, estimated at six feet below the current elevation. If water from rain or surface runoff exceeds the infiltration rate³⁰ in the pits, the accumulation could result in mass failures, especially on steeper slopes. Sites A, B, and C are on relatively level slopes and thus have a low risk of failure. Alternatives that include mining at Site D (PA, 6, 7, 10, 11) are associated with a greater risk of mass failure. The risk of failure due to sampling at Site D (Alternative 9) is almost as small as No Action and Alternative 8, which would not include any development of Site D. Effects of such a failure could be locally significant and could temporarily affect water quality and reduce land productivity for the foreseeable future. Future mining of the laterite deposit around site D (see Figure 13 in Chapter Three) would likely increase this risk.

Water that may accumulate in the pits could also exceed the holding capacity of the pits and spill out over the top. This would likely result in gullying of the hillslope at the point of exit. The sediment eroded from the gully might then be delivered to the stream system. This risk would be mitigated through the design of an exit point that is armored and does not drain toward any streams or unstable slopes.

Erosion and Sediment Delivery

Road construction and use is likely to generate sediment via loose material washed off the road surface during storms, and dust that is blown or carried off the road by vehicles. This sediment becomes relevant to water quality if it is delivered to the channel. Road segments closest to stream channels pose the greatest risk of sediment delivery. Most of the haul route is along existing roads segments. The existing road segments that lie nearest streams, presented in order of greatest to lowest risk of sediment delivery, based on professional judgement, are:

1. Road segment that parallels Alberg Creek (Alberg road).
2. Road segment that parallels unnamed tributary in the W ½ of SW 1/4 of section 34, hereafter referred to as 'section 34' tributary.
3. Road segment that parallels the unnamed tributary in the w ½ of se 1/4 section 4, hereafter referred to as 'section 4' tributary.
4. Road segment that accesses site D.

These segments are identified on a map in the Physical Science report in the Analysis Files.

²⁹Reclamation objectives emphasize minimum disturbance rather than re-contoured mine pits.

³⁰Infiltration rate has not been quantified.

The amount of sediment delivery predicted at these sites was estimated by multiplying road width (25 feet, in order to include cut and fill slope), segment length (see Figure 17), and depth of wash (0.25" across the surface). The estimate for depth of wash represents a maximum amount.

Erosion and sediment delivery are currently occurring at these sites, but do not appear to be limiting attainment of beneficial uses. Road use and reconstruction would disrupt the armor layer that develops under conditions of low or no use and delay the on-going recovery of these site. However, in all cases road would be designed to minimize risk of sediment delivery. Figure 17 identifies those alternatives that use these road segments, and the maximum amount of sediment estimated to become delivered to stream channels.

Road construction may also generate sediment. The new road segment of greatest concern is the 0.4 mile Bench Road adjacent to Rough and Ready Creek, included in Alternatives 7, 8 and 10. Coarse and fine material is likely to enter Rough and Ready Creek from this site. It is not possible to accurately estimate the quantity of sediment that would be introduced, but given the length of the road and observations from other sites, it is assumed to be between 50-100 cubic yards of material. Rough and Ready is capable of transporting this material through the system at high flows, but the material would likely remain where it falls during the summer and fall months.

The Proposed Action would also require 0.3 miles road construction within Riparian Reserves between Crossings #3 and #4. This route would need annual reconstruction because it is in Rough and Ready Creek's high water channel.

Road Segment (length)	PA	No Action	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Alberg (5280')	x	existing road	-	-	-	-	-	-
Section 34 (2800')	-	existing road	-	-	-	few trips with tracked vehicles	x	-
Section 4 (2200')	x	existing road	-	-	-	-	-	-
Access to Site D (1000')	x	existing road	x	x	-	-	-	-
New Construction Crossing # 3 to #4 (1580')	x	-	-	-	-	-	-	-
Bench Route (2000')	-	-	-	x	x	-	x	-
Est. Sediment Delivery From Above Roads	193 cubic yds	existing risk	19 cubic yds	119 cubic yds	100 cubic yds	1 to 5 cubic yards	154 cubic yds	existing risk

Figure 17. Sediment Sources and Estimated Delivery to Streams

Airborne dust may also be delivered to streams in the form of fine sediment. The risk of impact to beneficial uses is small and may be mitigated by dust abatement. There exists a trade off between impacts from use of water (discussed later in this chapter) or other dust abatement methods and the small risk of sediment delivery from dust.

The fine sediment washed off of road surfaces and into tributaries during storm events may negatively impact aquatic habitat, and water uses under the Proposed Action. The cubic yards associated with alternatives 6, 7 & 10, while not desirable are very likely not large enough to be measurable. Winter water clarity may be decreased by the Proposed Action, especially during the first storm of the season.

Fine sediment may also be generated at the mining pits and the stockpile sites. These sites are generally situated well away from existing drainage such that erosion is likely to be very minor. The highest risk is associated with ponding of water during the winter months, water over-topping the edge of the pit and gully creation. Pit design would be such that an armored surface or other mitigation would guard against this source. Similarly, the stockpile location would be engineered to mitigate for this concern. Sediment erosion from these sources is anticipated to be minor and less than 2 to 5 cubic yards annually at each site.

The use of Best Management Practices and Road Design Criteria (documented in the analysis files) are essential to reduce the amount of sediment delivered to Rough and Ready Creek from road projects.

Helicopter samples in Alternative 9 could accidentally drop ore during transport, with the possibility of up to 2 cubic yards falling into the creek system. Turbidity could exceed state standards if this occurred.

Indirect and Cumulative Effects

Accelerated sediment delivery can have adverse effects on many beneficial uses, including domestic water quality, swimming, visuals, and fish habitat. Sediment delivery from the alternatives is not likely to significantly degrade drinking water quality or visuals. The main stem of Rough and Ready Creek is noted for its unique geology, which is considered an Outstandingly Remarkable Value (ORV). The increased sediment associated with all action alternatives is not likely to degrade this ORV. However, the Proposed Action and to a lesser extent Alternatives 6, 7, 8, 10 and 11 may result in fine sediment delivery that could degrade summer rearing and/or fall spawning habitat (see detailed discussion about Fish later in this chapter). Mitigation described in Chapter Two would reduce fine sediment.

Past activities within the Rough and Ready Watershed have likely resulted in some accelerated sediment delivery. The amount of sediment or site-specific effects are not known. The amount of coarse material deposited in the braided channels and broad alluvial flats is inherently high. The current situation is considered optimum in terms of sediment regime (see Chapter Three, Figure 14 in the PETS Fish section).

No other proposed projects that might contribute significant volumes of sediment are currently proposed in the area. However, the existing road system would likely be expanded in future proposals given a successful initial operation. Increased sediment is the likely outcome; future approaches to mining would likely include measures to mitigate these effects and fish habitat protection remains a high national priority. Stream temperatures are not likely to increase due to sediment transport. Most of the sediment transport would occur during winter months when temperatures are not in a critical state.

STREAM CROSSINGS

Rough and Ready Creek and its tributaries would be exposed most directly to new sediment at the stream crossings where road fill is placed in the channel. Crossing construction would also result in sediment being supplied to the channel. The proposed crossing sites have been used in the past and disturbance to vegetation has already occurred.

The Proposed Action utilizes low-water fords that would wash out and be replaced annually. The surface of the crossing fill would consist of crushed rock of less than 3 inches, with fines washed out (“washed rock”).

Fine Sediment: Prior to winter flow, 100% of fines at low-water fords, 50% of the fines at culvert crossings, and 10% of the fines at bridge approaches, are estimated to be delivered to Rough and Ready Creek. These fines would move as suspended load when the winter flows reach higher levels. The fine material is expected to have a very low clay content, and thus would settle out of water column rapidly. This fine material would likely be transported during the first high-flow event of the season.

Under the Proposed Action, transport of the fines could exceed the ‘10% above background turbidity’ clause under OAR 340-41-365, (2) (c). The operator may apply for a permit for exception from this clause as specified under OAR 141-85-100 et seq (Removal and Fill Permits, Division of State Lands). Downstream water users may find that pumps and filters require more frequent maintenance and replacement, especially if water is withdrawn during turbid winter flows. Turbidity may affect water potability (resulting in a need for additional water treatment).

Alternatives 6, 7, 8, and 11 are associated with negligible risk of adverse impacts, but are likely to meet state standards. No Action and Alternatives 9 and 10 are unlikely to supply enough sediment to have any negative effect.

Coarse Sediment: Coarse sediment is likely to be transported during annual high flows and deposited downstream on Rough and Ready’s large alluvial fan. A low water year could result in sediment deposition nearer to the crossings. Significant impacts are unlikely.

Total Sediment: The total amount of sediment estimated to be delivered to Rough and Ready Creek from stream crossings is shown in Figure 18.

	PA	No Action	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Number of Main Crossings	7	Existing fords at Crossings #5, #6, #7.	3	4	2	0	1	1
Number of Tributary Crossings	9	Existing road crosses Alberg Creek 4 times, No Name once	3	3	3	*	1	3
Estimated Cubic Yd. Sediment from Crossings	585	0	35	39	16	<1	5	12

*One tributary crossing is on the Rock Creek route, limited trips with a tracked vehicle are possible.

Figure 18. Number of Stream Crossings and Estimated Sediment Delivery

Indirect and Cumulative Effects

Sediment delivery from the crossings in Alternatives 6 through 11 and No Action is not likely to significantly degrade drinking water quality or visuals. The greatest risk is with the Proposed Action, where local changes in channel slope may occur. Ten years of rock placement and downstream dispersal may become noticeable, but not significant (due the high stream power and the already dramatic effects of coarse sediment deposition at the lower reaches of Rough and Ready Creek and at its confluence of West Fork Illinois River). Increased sediment associated with the Proposed Action and all action alternatives is not likely to degrade the Hydrology/Geology ORV. However, the Proposed Action may block fish passage.

STREAM FLOW and WATER TEMPERATURE

Rough and Ready Creek has inherently low summer flows and high water temperatures. Summer flows are often critically low, and temperatures exceed state water quality standards. Rough and Ready Creek has been legally listed as impaired under the Section 303 (d) of the Clean Water Act. All alternatives would be required to meet DEQ standards relative to water quality and Total Maximum Daily Loads (TMDL) set by the state. Many aspects of the project may be consistent with DEQ and federal standards for water quality. Use of water for dust abatement, use of low-water fords, and development of the road near Crossing #3 are three actions that trend toward increasing water temperature and may not be consistent with standards.

Water Withdrawal for Dust Abatement

The Proposed Action and Alternatives 6, 7, 8, 10 and 11 would require dust abatement on some or all of the haul route. Water from Rough and Ready Creek would be most cost-effective to use in dust abatement and would reduce risk of introducing root disease or other foreign substance via water. Water withdrawal from Rough and Ready Creek, or other streams or rivers, would be subject to a water right by law. Water withdrawal would result in that much less water being delivered to Rough and Ready Creek and the West Fork Illinois River through either surface or sub-surface pathways.

The estimated daily use of water varies depending on road use and how much of the road system is watered, air temperatures, soil moisture, and humidity. Use of water for dust abatement could remove up to thousands of gallons for water per day from the creek, leading to lower flows and higher temperatures. Additional water (approximately 70 gallons per piece of equipment) may also be required for equipment washing and for the stockpile site.

Roads are assumed to be 20' wide, and water use is 0.2 gallons per square yard. Watering is assumed to occur 2 times per day for all haul miles.³¹ Both the total estimated gallons of water and the percent of an August low flow value by alternative is displayed below.

	No Action	PA	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Gallons per day	0	40,264	43,643	43,362	37,449	0	40,264	27,030
Percent of Low Flow (a 4cfs late August value)	0	1.56	1.69	1.68	1.45	0	1.56	1.05

Figure 19. Water Use Estimates for Dust Abatement

None of the action alternatives withdraw enough water to directly adversely affect aquatic values, however any reduction in water flow **trends** the watershed toward a degraded condition. This trend, while not measurable, would conflict with State Water Quality standards and the Total Maximum Daily Load (TMDL) process. The direct risk is lowest with the No Action and Alternative 9. The remaining alternatives are all very similar in terms of risk.

Use of Low Water Fords

The Proposed Action crossing designs would tend to pond water behind the built up fords and expose greater surface area to solar radiation. The amount of increased radiation would vary by site as a function of the geometry at that site. Generally, crossings with gently sloping banks (e.g. Crossing #1) have proportionally greater widths per rise in water elevation. The increase in water temperature would be negligible, but could lead to local changes in aquatic organisms at the sites and would not be desirable.

³¹The maximum amount of dust abatement is likely to be less than shown here, because not all roads are likely to be used for haul in any single day.

Road Development Near Crossing #3

Road development at Crossing #3, associated with the Proposed Action, may disrupt cold springs or through-flow channels in the No Name Fan Area, and lead to increased summer water temperatures in Rough and Ready Creek. Road construction in this reach is likely to displace the flow of these waters, measured as 5 to 10 degrees cooler than the mainstem creek. However, these changes are unlikely to increase overall temperatures in Rough and Ready Creek.

Indirect and Cumulative Effects - Low flow

Low flows have likely been reduced in the watershed from water withdrawal (see West Fork Illinois River Watershed Analysis for details). Continued development could lead to further withdrawals, depending on State-regulated water rights. Landowners with rights to the Wing and Farren Ditch are exploring ways to improve efficiency of water withdrawal and return water to Rough and Ready Creek.

Water withdrawal may lead to increased temperatures. Future water use would continue to exacerbate the inherently high summer water temperatures. These impacts are further discussed in the sections of PETS Fish and the Aquatic Conservation Strategy. Alternatives that call for potentially more water withdrawal would result in that much less water being delivered to the West Fork through either surface or sub-surface pathways.

If all 512 acres of laterites were mined, the trend toward decreasing water quality would be accelerated. Depending on the amount of road development and water withdrawal, effects could be measurable and could degrade beneficial uses.

Peak Flows

Changes to peak flows are not anticipated in the tributaries or mainstem of Rough and Ready Creek, due to proper drainage achieved with road design standards discussed in Chapter Two.

Compaction of the stockpile site may result in storm water runoff that would require engineering to properly disperse. Under any action alternative, this runoff would be designed to exit the site to a location that would minimize water and sediment delivery to the stream. There is a low risk associated with this issue under any alternative, but the ranking from least to highest risk is: No Action, #6=#7=#8=#10=#11, #9, PA. The Proposed Action (PA) and Alternative 9 have a higher risk because the Alternative 9 proposes a larger stockpile site, and PA proposes a site that is closer to Rough and Ready Creek than any of the other alternatives.

The indirect and cumulative effects of increases to peak flows are not expected to be discernable at the scale of the West Fork of the Illinois River, nor any point downstream. Cumulative impacts to peak flows are expected to be negligible, even if all foreseeable mining occurred. The additional road development would likely occur largely on ridgetops and the pits would likely be designed to drain at a variety of locations, reducing the likelihood that a large volume of overflow would become available to stream system simultaneously.

NICKEL CONCENTRATIONS IN THE WATER

Currently, the concentration of nickel in water samples exceeds the Department of Environmental Quality Ambient Water Standards for fish and water ingestion (13.4 parts per billion - also discussed in Chapter Three). Water samples taken in the mainstem of Rough and Ready Creek ranged from 13 to 17 parts per billion (ppb). Samples taken from tributaries and springs along the creek ranged from 11 to 36ppb. Samples taken from springs used for drinking water ranged from 30 to 40ppb. No Action and Alternative 9 would likely continue to generate similar concentrations; these amounts are considered background and inherent to the rock type through which the water flows. The Oregon Department of Environmental Quality is considering whether to list Rough and Ready Creek as Water Quality Limited due to the concentrations of nickel. *There are no current drinking water standards associated with nickel, nor are any of the concentrations reported in any samples cause for concern, according to the Oregon Department of Health* (see Kauffman memo in the analysis files). The mining of the laterite should present no problem to the chemical quality of waters within the watershed (Miller, et al 1998).

The delivery of nickel is associated with weathering of pyroxene and olivine, minerals in the peridotite rocks common in the Analysis Area. The oxidized nickel is not very soluble in the lateritic soil or serpentine rock, thus exposure or removal or stockpiling of these materials would not affect nickel concentrations in the water. The processes that would deliver elements such as nickel would not be affected, nor would any new elements would be introduced to the watershed in any alternative. Mining and associated activities may expose the peridotite rock to increased weathering and delivery of nickel.

Road construction, reconstruction and improvement are likely to expose fresh surfaces of peridotite and slightly increase the amount of nickel delivered to surface waters. The use of peridotite as road surfacing could also increase the concentration of nickel in the waters. Increases would be localized, and would spike initially, then progressively fall back to background levels over a period of years to decades. The spike is proportional to the amount of exposure - see figure 20 below. None of the alternatives are likely to significantly increase the nickel delivered to any drinking water sources. The springs beneath Mine Site B are not likely to be affected because all project roads drain well away from the springs. The one drinking water source in Rough and Ready Creek could be affected, but none of the alternatives would increase nickel levels to concentrations thought to harm human or aquatic health.

The IDT considered a recommendation by Dr. Miller from the USGS to avoid the use of peridotite as road surfacing. However, the team found that the risk of import of non-native plants through the use of non-native rock is more significant than the potential increase in nickel, thus continues to support the use of peridotite, as opposed to non-native material, for road surfacing. The mining proponent may request any rock source for use in road improvements under an approved Plan of Operations and the Forest Service would take appropriate action on the request.

	No Action	PA	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Acres of Pit developed	0	35	35	35	33	0.5	20	20
Haul Route Miles	0	14.3	15.5	15.4	13.3	0	14.3	9.6
Road Construction Miles	0	0.55	3.8	4.2	4.2	0	1.4	1.25
Road Reconstruction Miles	0	7.7	6.1	5.5	4.9	minor	8.8	6.0

Indirect and Cumulative Effects

Human activities on public and private land in and around peridotite rock may have led to increased concentrations of nickel within the watershed. Road construction, most of the residential development, and mine sampling occurred long enough ago that nickel levels have likely returned to background (Miller, personal communications 1999). Little fresh disturbance has occurred in the analysis area, with the exception of some road work and other development on private land in the lower reaches. Road development that may be necessary to accomplish 512 acres of mining could lead to increased weathering and more nickel in the water.

RISK OF HAZARDOUS MATERIAL SPILLS

The Proposed Action is associated with increased risk of fuel or other hazardous substances accidentally reaching Rough and Ready Creek, especially in the vicinity of the multiple stream crossings. People living within the analysis area have expressed concern that their drinking water could be fouled by an accidental spill. The risk of a serious spill is low, however the consequences may be serious and are dependant upon the beneficial uses of the water and its reaction to the material spilled. The most obvious hazard is hydraulic fluid and gas/diesel leaking or erupting during crossing. Some automotive oils would likely drip from vehicles; a spill plan would be required to respond to spills from broken lines or accidents.

The risk of hazardous substance spills is proportional to the number of exposure opportunities (vehicles crossing channels) and the risk of equipment failure at that moment(s). The risk at each crossing is proportional to stream width (length of exposure to risk), flow (seasonal or perennial), notification and reaction times, equipment quality and equipment maintenance. Crossings of Rough and Ready are wider and therefore pose more risk than tributary crossings. A spill plan is required in all action alternatives, including the Proposed Action and Alternative 9.

Figure 20 shows the number of annual round trips for ore trucks and the numbers of stream crossings for each alternative. This number does not include service or administrative vehicles, equipment move in and out, and other trips (estimated to increase the number of trips by about 15 to 20 percent). The risk of fluid spill is higher with alternatives that have more trips or more crossings. Alternatives 6 and 10 have relatively greater risk because they use smaller trucks that would require more trips to haul the same amount of ore. Approximately 20% additional traffic may be expected from incidental trips other than ore haul. No Action and Alternative 9 continue the current very low risk.

	Proposed Action	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Annual Number Round Trips	3,390	5,700	3,390	3,150	no ore hauling with trucks	3,100	1,940
Number Major Crossings	7 fills	3 bridge	3 bridge	2 bridge	none	1 bridge	1 bridge
Number Tributary Crossings	9	3	3	3	none with ore trucks	0	3

Figure 20. Estimated Number of Round Trips and Numbers of Crossings

Some residents drink water directly from the stream, thus a hazardous material spill could affect public health, especially in the event that the spill goes unnoticed and hazardous materials are ingested. This risk is low, but not zero. Compliance with state law would require reporting.

The potential for hazardous material to enter the groundwater also exists. Transport through the groundwater net and porous spaces in the soil make it far less likely that contamination would affect many, if any human water uses (shallow wells). PETS fish and other aquatic organisms may also be killed by a major spill. No other activities that could increase the risk of hazardous material spill are known in the analysis area.

A fuel transportation plan is required in all action alternatives. The plan would assure that fueling is done outside riparian reserves and proper safeguards for fuel transportation are in place. In Alternatives 6, 7, 8, 10, 11 and the Proposed Action, fuel would be transported in pick-ups or other small trucks. Under Alternative 9, fuel would need to be transported via helicopter.

Fears about toxicity of the ore and drinking water quality have been raised and are discussed elsewhere in this chapter. The mining of the laterite should present no problem to the chemical quality of waters within the watershed (Miller, et al 1998). No sulfides are known to occur within the watershed, thus acid mine drainage is not likely.

The pits themselves may fill up with water and produce conditions which would result in a chemical reduction of iron and other metals. This reduction would be similar to that of existing Darlingtonia bogs and ponds located on public and private lands within serpentine soils within the watershed and across the county. No adverse reactions from these existing water saturated conditions have occurred. No adverse chemical reactions are predicted if the pits do fill up with water and produce similar chemical conditions.

PROPOSED, ENDANGERED, THREATENED and SENSITIVE (PETS) FISH SPECIES

Figure 21 displays potential effects of the Proposed Action and its alternatives on the Fish Habitat Indicators discussed in Chapter Three.

Factors Indicators	Lower Rough and Ready Creek Reach (Response Reach)			Effects of the Proposed Action, Action Alternatives, and the No Action Alternative		
	Optimum	Marginal	Outside Optimum Range	Restore	Maintain	Degrade
<u>Water Quality</u>			x		6,7,8,9,10,11, NA	PA
Temperature						
<u>Habitat Access</u>		x			6,7,8,9,10,11, NA	PA
Physical Barriers						
<u>Habitat Elements</u>						
Sediment	x				NA,9	PA, 6,7,8,10,11
Large Wood		x			6,7,8,9,10,11, NA, PA	
Pool Character and Quality		x			PA, 6, 9, 11, NA	7,8,10
Off-channel Habitat		x			6,7,8,9,10,11, NA	PA
<u>Channel Conditions and Dynamics</u>						
Width/depth ratios		x			PA,6,7,8,9,10, 11, NA	
Stream-bank Condition		x			9,11, NA	PA, 6,7,8,10
Floodplain Connectivity		x			6,7,8,9,10,11, NA	PA
<u>Flow/Hydrology</u>	x				PA,6,7,8,9,10,1 1, NA	
Changes in peak flows						
<u>Watershed Conditions</u>						
Road Density / Location		x			NA, 9	PA, 6,7,8,10,11
Human Disturbance History		x			NA	PA, 6,7,8,9,10,11,
Riparian Reserves		x			NA,9	PA, 6,7,8,10,11
Landslide and Erosion Rates	x				NA,9	PA, 6,7,8,10,11
<u>Harassment or Incidental Take</u>	x				NA,9	PA,6,7,8,10,11

Figure 21. Matrix of Factors and Indicators for Fish Habitat - Effects of the Alternatives

Discussion of Potentially Degraded Factors or Indicators

Temperature - The Proposed Action may result in increased water temperature in the vicinity of stream crossings. None of the other Alternatives are associated with this risk. The design of the crossings under the Proposed Plan of Operations may not meet state water quality standards relative to temperature.

Habitat Access - Low-water fords associated with the Proposed Action may impede fish passage at main stem and South Fork Rough and Ready Creek crossings during low flows, thus the “degrade” rating. Avoiding crossings or using bridges would maintain existing habitat access. Water withdrawals for the Nicore project are not expected to affect fish passage.

Sediment Regime - The previous discussion on sediment reveals that all action alternatives may increase the risk of fine sediment reaching the main channel of Rough and Ready Creek. Fine sediment delivery can reduce overall carrying capacity in the immediate vicinity of the proposed stream crossings, relative to both summer rearing and fall spawning habitat. Chinook salmon that may spawn immediately downstream of the proposed crossings may suffer from increased fines covering nests. At these sites, intra-gravel fines may be increased greater than 20 percent above existing background prior or just after fall spawning (see S&G 11-3 in the Siskiyou National Forest Plan). Steelhead, spawning much later in the season, are not likely to be adversely affected by this sediment. Some direct impacts to aquatic organisms can be expected during Bench Road construction. Sediment contributed from the road construction would likely be flushed out during high flows, but carrying capacity during low flows could be reduced until the sediment is transported downstream.

Large Wood - No significant direct effects on large wood would be expected from the alternatives. However, if Port-Orford-cedar root disease is introduced into these areas, the supply of large wood to the creeks may eventually (over decades) become degraded.

Pool Quality and Character - Main channel pool quality and character is likely to be maintained in all Alternatives. The “degrade” rating for Alternatives 7, 8 and 10 is related to the potential for large pieces of bedrock to be pushed into the creek from the Bench Road construction. This potential would be somewhat mitigated through road construction specifications, but cannot be completely eliminated.

Off Channel Habitat - The Proposed Action could potentially degrade off channel tributary habitats adjacent to the confluence of No Name Creek and the main stem of Rough and Ready Creek. All other alternatives are expected to maintain these habitats.

Stream Bank Condition - The Proposed Action and Alternatives 6, 7, 8, and 10 have the potential to degrade stream bank conditions at the proposed stream crossings through loss of vegetation, disruption of streamside springs, and bank erosion. The existing crossings have already disturbed streambanks in some locations. The Proposed Action is associated with the highest risk of further degradation. The No Action Alternative, Alternative 9 and Alternative 11 are expected to maintain the current condition.

Floodplain Connectivity - The Proposed Action would develop a road that may impact the No Name Fan, with the potential to disrupt floodplain connectivity between Crossings #3 and #4. The alternatives avoid this possibility.

Watershed Condition - Human disturbance would be increased in the Proposed Action and all action alternatives. All (except Alternative 9) include road development within Riparian Reserves. The more road development, including crossings, the more potential to degrade the watershed condition. Gates would mitigate some, but not all of the risk. Alternative 9 would constitute human disturbance in the area for five years, other alternatives would continue disturbance for ten years.

Harassment or Incidental Take - All Action Alternatives increase the risk of harassment and/or incidental take. Bench Road construction within Alternatives 7, 8 and 10 include additional risk from the blasting or ripping of bedrock immediately adjacent to the main stem, which could result in the direct take of steelhead. Mitigation to reduce the risk of rock fall into the creek would be employed.

Biological Evaluation Summary

The Proposed Action and Alternatives 6, 7, 8, 10 and 11 are associated with **“May Affect, Likely to Adversely Affect”** findings³² for chinook and coho salmon (chinook are proposed for listing under the Endangered Species Act, coho are currently listed as threatened). Critical habitat for these species (300 feet on either side of coho-bearing streams) may be adversely affected by these alternatives. Alternative 9 and No Action are associated with a **“No Effect”** finding for chinook and coho.

The Proposed Action and action alternatives **May Impact** the R6 sensitive species’ steelhead and cutthroat trout but **Will Not Likely Contribute** to a trend toward a federal listing or cause a loss of viability to the population or species.

Cumulative Effects

Active and proposed projects on federal lands that may affect listed species are submitted to the National Marine Fisheries Service (NMFS) as part of an annual programmatic Biological Assessment for Rogue River basin fish species. NMFS is aware of the Nicore project, but since the Preferred Alternative has no effect on any listed or sensitive fish, formal consultation was discontinued.

Within the watershed, the effects of past activities on fish are unknown. Three water diversions on the main stem inhibit adult fish migration during low flow conditions. The conditions for fish prior to construction of the diversions is unknown.

Many fish habitat characteristics would be affected by foreseeable future mining. Adverse effects on physical conditions described above (sediment, temperature, streamflow) could reduce carrying capacity for fish. Trends toward warming water could change the population and distribution of some species. Factors and Indicators degraded under the PA would be further degraded given mining of all 512 acres of laterite ore and haul via road. Other indicators could also be at risk (large wood, pools).

³² “Likely to adversely affect” means that the project has more than a negligible potential to adversely affect these species. The finding is based on the Matrix of Factors and Indicators.

PORT-ORFORD-CEDAR ROOT DISEASE

The Proposed Action, and Alternatives 6, 7, 8, 10 and 11 all increase the risk of importing Port-Orford-Cedar (POC) root disease into the analysis area. Mitigation measures can effectively reduce the risk, given consistent application.

The amount of POC along the haul routes affects the degree of risk. The consequences of disease introduction are site-specific. The West Fork Illinois River Watershed Analysis and physical science reports further describe the function of POC and factors related to root disease spread in the area.

If introduced, the disease would have its greatest impact along Alberg Creek (particularly one mile through Section 10). POC is the major large tree component in this area, and understory POC are lacking. Alternatives 6 through 11 avoid this route.

The No Name Fan is another area of specific concern where about 5 acres of large POC are growing. This fact that this area is low-lying and tends to concentrate water also increases the risk of POC root disease infestation. Alternatives 6 through 11 avoid this area. The Proposed Action would traverse it twice.

POC is the primary shade-producing tree in Alberg Creek and the No Name Fan area; water temperature at these locations may increase over time if the trees die. The ridge-top road to Site A is associated with some concern that it could facilitate unrestricted access from Parker Creek.

The following mitigation measures would apply to the Proposed Action and alternatives as applicable:

- a wash station equipped with high pressure water equal to or greater than 125 psi through a quarter inch nozzle and adequate drainage. The wash station may be located in Cave Junction.
- equipment would have to be washed before operations begin or if the equipment works elsewhere and returns mid-season
- Water used for washing vehicles would come from a clean source (as defined by the Forest Service/BLM) or would be treated with clorox.
- Road construction and improvement work would be done during the dry season (June 15 through October 15 - work on the north side of Rough and Ready Creek would not occur after September 15 except under the Proposed Action and Alternative 11). No wet season operation would be approved.
- Road specifications would establish and maintain an inslope road template and berms to prevent downslope flow (as topography and site conditions allow).
- Clean sources of rock would be required for road surfacing (as defined by the Agencies).
- Road improvement specifications consider adding rock to wet spots.
- Where possible, coordinate prevention and disease control activities with adjacent landowners and Agencies.
- Roadside Sanitation of POC (Removing POC from within 25 feet of roads)
- Lifting and paving of the roadway 50 feet on either side of infested areas near the West Fork Illinois River (applies only to Alternative 10).

Port-Orford-cedar Root Disease Risk Assessment by Alternative

The Proposed Action - The Proposed Action crosses Alberg Creek several times. It includes two or more routes across the No Name Fan area where there are some large POC. The risk is reduced by limiting operations to the dry season. The risk would be highest when roads were wet but passable.

The No Action Alternative - The No Action Alternative continues the existing risk of introduction of POC root disease into the analysis area. The risk is highest along the private land in Section 14. POC grows along the ditch on the private road. Residential traffic is likely to import the disease in the foreseeable future. Residents could employ disease control measures such as roadside sanitation to reduce the risk of introduction. This analysis assumes that residents do not employ such measures. Another potential introduction site is the Mars swimming hole, also in Section 14. Alberg Creek would remain inaccessible, which reduces the risk of disease introduction into that drainage.

Alternative 6 - Alternative 6 includes a haul route along private Rough and Ready Creek Road, which is a high risk area for introducing the disease. The high number of trips through the private land exacerbates the risk. The crossing of No Name Creek is another potential risk site. Construction of the ridge road could make access from the north (via Parker Creek) possible during the wet season. Paving the private road would also reduce the risk. The residents along the private road would be encouraged to agree on disease control measures.

Alternative 7 - Alternative 7 is associated with fewer risk factors than the Proposed Action or Alternative 6. Alternative 7 constructs the ridge road, which could make access from the north (via Parker Creek) possible during the wet season. It also includes the crossing of No Name Creek on Road 438.

Alternative 8 - Alternative 8 is associated with risk similar to Alternative 7. The road to Site D would be eliminated, but that route does not have significant populations of POC.

Alternative 9 - Alternative 9 is also expected to maintain the existing condition relative to POC introduction. Access to the two areas of most greatest concern would be eliminated. Bringing tracked vehicles to Site B via the Rock Creek route moves equipment between an infested area (West Fork Illinois River) and an uninfested area (away from the river toward Rough and Ready Watershed). Limits on the number of trips and timing of the trips (dry season only) and equipment cleanliness is expected to effectively reduce the risk of spreading the disease. See Appendix J for a containment strategy specific to Alternative 9.

Alternative 10 - Alternative 10 accesses Site B (and the cable landing site for Site D) from the Wimer Road. POC root disease is spreading down the West Fork Illinois River and has been found along the Wimer Road. Alternative 10 would increase the risk of spreading the disease to healthy populations of POC above the Wimer Road toward Site B. Lifting and paving the road on either side of infested sites near the Illinois River would be recommended. Alternative 10 would include a crossing of No Name Creek.

Alternative 11 - Alternative 11 includes a haul route along private Rough and Ready Creek Road, which is a high risk area for introducing the disease. Alternative 11 would make fewer trips, therefore the risk is reduced as compared to Alternative 6. The risk would also be increased by installing a year-around bridge could allow traffic when the roads are wet. However, roads would not be improved to Site A or D, reducing the accessible mileage. The crossing of No Name Creek is another high risk site.

Dr. Don Zobel of Oregon State University has stated that the risks and consequences of POC root disease introduction are greater than estimated in this EIS. The Agencies acknowledge that Dr. Zobel is a credible expert regarding POC and the disease. The mitigation measures considered will not completely eliminate the risk of introduction.

NOXIOUS WEEDS

In general, weed competition is not a significant threat to sensitive plant habitat within the project area, still, measures to reduce the risk of spreading weeds are recommended.

Proposed Action - The Proposed Action is associated with the greatest risk of spread of noxious weeds. It increases access throughout the watershed. It also includes a stockpile site very near the known star thistle population.

No Action Alternative - The No Action Alternative maintains the current risk of spread of noxious weeds. Much of the analysis area is not accessible to motorized vehicles, and traffic via the existing road on private land is limited by residents. The private land and miner's residence are areas of the highest risk of establishment of noxious weeds.

Alternative 6 - Alternative 6 includes access via the higher risk private Rough and Ready Creek Road. It also would construct 3.8 miles of new road, and improve access along a ridge between Parker and No Name Creeks. It would include mitigation to reduce the risk of spreading noxious weeds. Access would be limited to mining-related traffic. Vehicle washing included in the POC mitigation would also help reduce the spread of noxious weeds from outside the analysis area. The alternative stockpile site would be located away from known noxious weed populations.

Alternative 7 and 8 - Alternatives 7 and 8 include about 4.2 miles of new road construction. Disturbed areas such as new roads are associated with increased risk of noxious weeds establishment. This alternative would include mitigation to reduce the risk of spreading noxious weeds. Access would not be increased into the watershed for all but mining-related traffic. Vehicle washing included in the POC mitigation would also help reduce the spread of noxious weeds from outside the analysis area. The alternative stockpile site would be located away from known noxious weed populations.

Alternative 9 - Alternative 9 is also expected to maintain the existing condition relative to noxious weeds. Use of helicopters versus trucks significantly decreases the risk of spreading weeds to the mine sites and along haul routes. Risks of spreading weeds would be low. Helicopters would not land at any mine sites. Mitigation is in place to reduce or eliminate risks. Monitoring for the spread of noxious weeds would be required. Alternative 9 would locate the stockpile site away from noxious weeds. Mitigation regarding POC would also help reduce the risk of noxious weeds.

Alternative 10 - Alternative 10 increases access up the Rock Creek Road. The Wimer Road is a higher risk area for introduction of noxious weeds due to unrestricted public traffic. A large population of scotch broom exists along the Wimer Road between Hwy 199 and the National Forest Boundary. A cooperative agreement with private landowners to eradicate this population of scotch broom is recommended. Alternative 10 would include mitigation to reduce the risk of spreading noxious weeds. Vehicle washing included in the POC mitigation would also help reduce the spread of noxious weeds from outside the analysis area. The alternative stockpile site would be located away from known noxious weed populations.

Alternative 11 - Alternative 11 would use the private Rough and Ready Creek route, which is a high risk area. Alternative 11 also includes a mile of new road construction. It would include mitigation to reduce the risk of spreading noxious weeds. Access would be limited to mining-related traffic. Vehicle washing included in the POC mitigation would also help reduce the spread of noxious weeds from outside the analysis area. The alternative stockpile site would be located away from known noxious weed populations.

BOTANICAL DIVERSITY/SENSITIVE PLANTS

Several FS sensitive and BLM special status plants are found along the haul route and mine sites proposed in various alternatives. Direct negative effects can include uprooting, burial, or crushing of plants while excavating the mine sites, or upgrading, building, or maintaining roads. Ore stockpiling can also bury or crush plants. Indirect impacts include soil disturbance that may render the habitat unsuitable for the plants. Light soil disturbance favors establishment and growth for some rare species (such as Howell's mariposa lily and Howell's streptanthus). Intense soil disturbance would have negative effects on Howell's mariposa lily, Siskiyou fritillaria, red-root yampah, and Siskiyou butterweed. Heavy soil disturbance, including churning and compaction, is incompatible with maintenance of suitable habitat for rare plants--the plants cannot survive or colonize heavily disturbed sites. Mining and road development and use would lead to heavy disturbance.

Within the analysis area, suitable habitat for many species exists, but is currently not occupied. Some of this suitable, but unoccupied, habitat may be disturbed through the mining and associated activities.

Soil disturbance may also favor noxious weeds or other more common plants. Reclamation is not expected to completely restore the area to pre-mining conditions and recovery is expected to be slow.

Some people have suggested that dust and air pollution generated by the project could affect vascular or other plants (lichens, mosses, etc.). Some effects are possible, but would be limited by meeting all air quality standards and the use of dust abatement. Dust and air pollution are not likely to have detectable impacts.

Roads may also adversely affected some plant habitats through disruption of drainage. Road drainage may also create new wet habitats. Individual plants may be affected by drainage disruptions. The impacts cannot be precisely predicted. Most impacts would be avoided through careful road design but some risk would remain.

Figure 22 displays the numbers of sites documented within 100 feet of the haul routes, or within the mine sites themselves. Most of the data comes from surveys completed in 1997 and 1998. Surveys were concentrated along the haul route and within the mining sites; this is an appropriate survey strategy for a project of this scale. The No Action Alternative would not directly impact any of these sites.

	PA	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Number of Species on Haul Route/Mine Sites	57	64	84	60	10	81	38
Number of Plant Sites on Haul Route/Mine Sites	11	10	11	11	3	12	8

Figure 22. Numbers of PETS Plant Species and Plant Sites on the Haul Routes

Botanical Evaluation Summary

FS policy requires preparation of a Biological Evaluation (BE) so that PETS species receive full consideration in the decision-making process (FSM 2672.41). Discussions about the rare plant protection policies of both agencies are in the analysis file. Appendix G included in this FEIS describes the locations and impacts predicted from the Proposed Action and alternatives in more detail.

The findings displayed here are based on the worst case scenario. The species associated with “**Will Impact**” findings are Oregon Natural Heritage Program (ONHP) List 1 and/or potential impacts sites are located within “selected habitat” identified in Draft Species Management Guides. The “**Will Impact**” findings may be reduced during implementation if the road can be routed around significant sites.

Arabis “macdonaldiana” is listed as Endangered under the Endangered Species Act. It is also an Oregon Natural Heritage Program (ONHP) List 1 species. The Proposed Action and Alternatives 6, 7, 8 and 10 are associated with a “**May Effect - Likely to Adversely Affect**” finding. This finding may be reduced to “**May Effect - Not Likely to Adversely Affect**” by routing the road away from the known sites. No Action, Alternative 9, and Alternative 11 avoid these sites and are associated with a “**No Effect**” finding. Formal consultation with Fish and Wildlife Service has not been initiated since the Preferred Alternative is associated with No Effect. If the Proposed Action or Alternatives 6, 7, 8 or 10 were selected, consultation would be required.

Calochortus howellii is a BLM sensitive species, a FS R6 sensitive species, and is an ONHP List 1 species. A Draft Conservation Management Guide has been prepared for this species. The population along the haul route lies within “selected habitat” in the Draft Guide. It is abundant within its selected habitat, and the haul route makes up a limited portion of the is area. It may also be impacted by the Proposed Action stockpile site.

For the Proposed Action and all action alternatives (except Alternative 9), this species is associated with a **“Will Impact Individuals or Habitat with a Consequence that the action May Contribute to a trend towards federal listing or a loss of viability to the population or species”** finding. The alternative stockpile site would avoid this plant. In addition, bulbs may be removed from the impacted area and replanted in a more protected area. No Action and Alternative 9 are associated with a **“May Impact”** finding due to the effects of the existing roads.

Cardamine nuttallii var. *gemmata* is a R6 sensitive species. The Proposed Action and Alternatives 6, 7, 8 and 10 is associated with a **“May Impact Individuals or Habitat but Will Not Likely Contribute** to a trend towards a federal listing or cause a loss of viability to the population or species” finding. A close relative *Cardamine nuttallii* var. *dissecta* is a BLM “tracking species”. It is within 100 feet of the haul route on BLM. No Action, Alternative 9 and Alternative 11 have a **No Impact** determination for this species.

Epilobium oreganum is a FS R6 sensitive species, a BLM sensitive species and an ONHP List 1 Species. Alternative 10 **“May Impact Individuals or Habitat but Will Not Likely Contribute** to a trend towards a federal listing or cause a loss of viability to the populations or species. The Proposed Action and all other alternatives are associated with a **“No Impact”** finding.

Gentiana setigera is a FS R6 sensitive species and an ONHP List 1 Species. The Proposed Action and all alternatives except Alternative 10 are associated with a **“No Impact”** finding. Alternative 10 is associated with a **“Will Impact Individuals or Habitat with a consequence that the action May Contribute to a trend towards federal listing or a loss of viability to the population or species”** finding.

Fritillaria glauca is a FS R6 sensitive species and BLM special status species. No Action and the Preferred Alternative 9 are associated with **No Impact**. The Proposed Action and all other action alternatives are associated with a **“May Impact Individuals or Habitat but Will Not Likely Contribute** to a trend towards a federal listing or cause a loss of viability to the population or species” finding.

Microseris howellii is a FS R6 sensitive species, a BLM special status species and an ONHP List 1 species. It is also considered “Threatened” on lands managed by the State of Oregon. A Draft Species Management Guide has been prepared for this species, and selected habitat includes the Rough and Ready Botanical Area and ACEC. No Action and Alternative 9 are associated with a **“No Impact”** finding for this species. The Proposed Action and Alternatives 6, 7, 8, 19 and are associated with a **“Will Impact Individuals or Habitat with a Consequence that the action May Contribute** to a trend towards federal listing or a loss of viability to the population or species” finding.

Mimulus douglasii is a BLM tracking species. One site has been documented on BLM near the haul route. This site is expected to be avoided through careful road activities. The Proposed Action and all action alternatives are associated with a **“May Impact Individuals or Habitat but Will Not Likely Contribute** to a trend towards a federal listing or cause a loss of viability to the population or species” finding. No Action is associated with a **“No Impact”** finding for this species.

Monardella purpurea is a FS Sensitive Species and a BLM special status species. A Draft Species Management Guide has been prepared for this species. Selected habitat occurs within the West Fork Illinois River Watershed. No Action and Alternative 9 are associated with a **“No Impact”** finding for this species. The Proposed Action and Alternatives 6, 7, 8, 10 and 11 are associated with a **“Will Impact** Individuals or Habitat with a consequence that the action **May Contribute to a trend towards federal listing** or a loss of viability to the population or species” finding.

Perideridia erythrorhiza is a FS R6 and BLM special status species and an ONHP List 1 species. There are few known sites on the Siskiyou National Forest. No Action and Alternative 9 are associated with **“No Impact”**. The Proposed Action and Alternatives 6, 7, 8, 10 and 11 are associated with a **“Will Impact** Individuals or Habitat with a Consequence that the action **May Contribute** to a trend towards federal listing or a loss of viability to the population or species” finding for this species.

Salix delnortensis is a FS R6 sensitive species and a BLM special status species. No Action and Alternative 9 are associated with a **“No Impact”** finding. The Proposed Action and Alternatives 6, 7, 8, 10 and 11 are associated with a **“May Impact** Individuals or Habitat but **Will Not Likely Contribute** to a trend towards a federal listing or cause a loss of viability to the population or species” finding.

Senecio hesperius is a FS R6 and BLM sensitive species, and an ONHP List 1 species. A Draft Species Management Guide has been prepared that considers the Rough and Ready Botanical Area selected habitat. No Action and Alternative 9 are associated with a **“May Impact”** finding, due to locations on existing roads. The Proposed Action and Alternatives 6, 7, 8, 10 and 11 are associated with a **“Will Impact** Individuals or Habitat with a Consequence that the action **May Contribute** to a trend towards federal listing or a loss of viability to the population or species” finding. This species may also occur in the Proposed Action stockpile site. The alternative site avoids this species.

Streptanthus howellii is a FS R6 and BLM sensitive species, and an ONHP List 1 species. For the Proposed Action and Alternatives 6, 7, 8, 10 and 11, this species is associated with a **“Will Impact** Individuals or Habitat with a Consequence that the action **May Contribute** to a trend towards federal listing or a loss of viability to the population or species” finding. Alternative 9 is also associated with a **“Will Impact”** finding, however, it is **not likely** to result in a trend toward federal listing or cause a loss of viability. No Action is associated with a **“May Impact”** finding, due to effects from existing roads to this species.

Viola primulifolia ssp. occidentalis is a FS R6 and BLM sensitive species, and an ONHP List 1 species. It grows in fens with other Siskiyou endemic species including darlingtonia. The haul route in all alternatives (except 9) comes very close to one fen where this plant grows. Road widening in Alternative 10 may also lead to adverse effects. Thus, the Proposed Action and Alternatives 6, 7, 8, 10 and 11 are associated with a **“May Impact** Individuals or Habitat but **Will Not Likely Contribute** to a trend towards a federal listing or cause a loss of viability to the population or species” finding. No Action and Alternative 9 are associated with **“No Impact.”**

Cumulative Effects

Much of the project area has been impacted by mining, roading, and botanical collecting of rare plants. The pre-settlement distribution of rare plants is unknown. Most of the private lands have been cleared or otherwise developed.

If the laterite mining proved successful, more habitat and individual plants would likely be disturbed as more of the deposit was mined. Cumulative impacts are not precisely known, since the population distribution on all laterite deposits have not been inventoried. Cumulative impacts are likely similar to direct and indirect impacts; plants that grow along the haul route and within the mine sites are also likely to be found in neighboring areas. Continued inventories are recommended and may be required for future Plan of Operations that disturb more lands.

ACEC and MA-4 (Botanical Area) Standards and Guidelines

BLM and FS guidelines emphasize protection of the botanical resources in these areas. The overall principle of management for Botanical Areas is described in the Siskiyou National Forest Plan:

“Natural, physical and biological processes will prevail without human intervention. Plan life inhabiting this ecosystem will continue to flourish. The goal is to protect, preserve, and enhance the exceptional botanical features of the area.”

FS S&G MA4-10 states that “every effort should be made to protect botanical resources, especially sensitive plant species.” The mitigation described in Chapter Two is intended to meet this guideline.

About 7.7 miles of road currently exist within the Botanical Area and ACEC. Mine site C is within the Botanical Area; no sensitive plants are documented at the mine site. Reclamation is not expected to completely restore the area to pre-mining conditions and recovery is expected to be slow.

	PA	NA	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Mi. New Construction in FS MA-4	0.3	0	0	0.4	0.4	0	0.4	0
Mi. Haul Route in FS MA-4	3.8	0	2.9	3.8	2.8	Limited Trips	3.5	1.9
Mi. ACEC Road Development	0.75	0	0.75	0.75	0.75	0.75	0.75	0.75

Figure 23. Road Construction and Reconstruction within the Botanical Area and ACEC.

ACEC guidelines are in the ACEC Management Plan. The use of the ACEC for stockpiling and ore haul is consistent with the guidelines.

AQUATIC CONSERVATION STRATEGY and RIPARIAN RESERVE STANDARDS AND GUIDELINES

Aquatic Conservation Strategy

This analysis of the Aquatic Conservation Strategy objectives integrates many of the previous discussions and provides further context for analysis of direct, indirect, and cumulative effects.

1. Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features to ensure protection to the aquatic systems to which species, populations and communities are uniquely adapted.

The Proposed Action and all of the alternatives may be expected to maintain the distribution, diversity, and complexity of the Rough and Ready Creek watershed and landscape-scale features.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Spatial and temporal connectivity would be degraded by road development and use between Crossings #3 and #4 in the Proposed Action and maintained in all other alternatives.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

The physical integrity of the aquatic system as a whole is likely to be maintained, however shorelines and streambanks may be degraded at stream crossings in all action alternatives except 9. Alternatives that reduce the number of stream crossings (10, 11) better meet this objective.

4. Maintain and restore the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Water quality may be degraded in all of the action alternatives except #9 (see physical science report). State water quality standards may be exceeded for short duration and distance downstream from the crossings, which leads to a degrade finding for sediment relative to the PETS fish analysis previously discussed.³³ The Proposed Action, with its low water fords and greatest amount of riparian disturbance, would have the greatest impact on water quality. The project is associated with a variety of risks, including potential for slope instability at Mine Site D, additional sediment delivery from road construction and reconstruction, increased nickel concentrations and hazardous substance spills at crossings.

³³Duration and distance downstream varies with the size of the storm event. Bedload movement on coarsely bedded stream channels has been shown to be chaotic, with material moving 10's to 100's of feet downstream following flows large enough to mobilize the bed material.

Unless there are high magnitude landslides, and/or serious hazardous material spills, the water quality would be expected to remain within the range that currently supports biological, physical, and chemical integrity.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage and transport.

Site-specific changes in timing (under low flow conditions), volume, rate, and character of sediment input, storage, and transport can be expected in the vicinity of the proposed vehicle crossings and along road segments very close to streams. Direct impacts to individual aquatic organisms are possible during road development activities and use. See sections on slope stability and erosion, and stream crossings for alternative comparisons. In general, the Proposed Action is associated with the greatest risk of increased sediment and Alternative 11 is associated with the least risk (except for No Action and Alternative 9, which have no road development in riparian reserves).

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high and low flows must be protected.

The Proposed Action and all of the alternatives are expected to maintain in-stream flows sufficient to create and sustain riparian and aquatic habitats. Water withdrawal of several thousand gallons per day may occur within the Proposed Action and Alternatives 6, 7, 8, 10, and 11, given a state water right. Wetland habitat associated with the “No Name Fan” would be degraded in the Proposed Action. Alternatives 6, 7, 8, 10, and 11 cross the fan, but avoids most of it. Wetland habitat also occurs near Crossing #6, the Proposed Action, and Alternatives 6 and 7 may impact this habitat. The use of the existing Alberg road may interfere with down wood routing in the Proposed Action.

Impacts to peak flows are not expected, due to low road density overall. While the risk is very low to non-existent any alternative, it is higher under those alternatives that reconstruct and use the greatest number of road miles.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Road development within the Rough and Ready floodplain is not expected to affect the timing, variability, and duration of the floodplain inundation. Neither stockpile site lies within the federally mapped 100 year floodplain. However, the placement of the stockpile under the Proposed Action is adjacent to an overflow channel that is visible on air photographs.

Some impacts to small wetlands and fens may occur from road development near Crossings #1, #3, and #6. The effects to wetlands and springs varies by alternative. The wetland/spring complex near Crossing #3 would be particularly affected by the Proposed Action. Construction and reconstruction roads in this area would disrupt flow patterns; exact results can not be predicted, but it is likely that some wetland habitat would be displaced and some may be lost.

Other roads proposed for new construction do not cross known wet areas. The small wet area near

Crossing #6 may already be impacted by the existing road, through concentration and routing of water down the road. The Proposed Action and Alternatives 6 and 7 would maintain this road and could result in further down-cutting of the road surface and change surface and groundwater distributions in the vicinity of the wet area. Bedrock springs that are recharged by deep ground water sources are not expected to be influenced by this project.

8. *Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of woody debris sufficient to sustain physical complexity and stability.*

Some plant species within riparian areas may be affected by road construction, reconstruction and use within all of the action alternatives except Alternative 9 (see Sensitive Plant analysis). Rare species at risk include fen species such as darlingtonia and western bog violet, and riparian species such as Del Norte willow. Alternatives that reduce the amount of road development in riparian areas are associated with less risk. Structural diversity of plant communities, and maintenance of summer and winter thermal regulation are not likely to be directly affected by any alternative; however, indirect effects based on the introduction of POC root disease may, in the long run, reduce diversity and thermal regulation within Alberg Creek and the No Name Fan area. Noxious weed introduction could also indirectly impact species composition and structural diversity by out-competing native vegetation. Loss of vegetation is not likely to affect maintenance of nutrient filtering, and/or appropriate rates of surface erosion, and channel migration. Bank erosion may be accelerated by loss of vegetation at crossings (see physical science report for alternative comparison).

9. *Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.*

The Proposed Action and all alternatives are expected to maintain habitat to support well-distributed populations of wildlife within the analysis area. No wildlife species would be extirpated or otherwise significantly affected by the project. Many sensitive plant species, however, may be adversely affected by the alternatives.

Riparian Reserve Standards and Guidelines

Roads Management

RF-1. *Federal, state, and county agencies should cooperate to achieve consistency in road design, operation and maintenance necessary to attain Aquatic Conservation Strategy Objectives:*

The Forest Service is working with the BLM and state agencies to achieve consistency in road design, maintenance and overall access.

RF-2. *For each existing or planned road, meet ACS objectives by:*

a. minimizing road and landing locations in Riparian Reserves

The Nicore project requires significant road development within Riparian Reserves. Figure 24 shows the amount of road development and new construction within Riparian Reserves, and numbers of major and tributary stream crossings. Those alternatives with the least road development within the reserves, and with the fewest stream crossings, would best meet this guideline. The Proposed Action does not minimize disturbance to Riparian Reserves.

	Alternatives						
	PA	6	7	8	9	10	11
Mi. New Road in Riparian Reserves (RR)	0.3	0	0.4	0.4	0	0.4	0
Mi. Haul in RR	4.6	2.4	3.1	1.8	0	1.4	1.1
No. Major Stream Crossings	7	3	4	2	0	1	1
No. Tributary Crossings	9	3	2	2	1	1	3

Figure 24. Road Development and Use Within Riparian Reserves

b. completing watershed analysis (including appropriate geotechnical analysis) prior to the construction of new roads or landings in Riparian Reserves.

The West Fork Illinois River Watershed Analysis was completed in 1997 and is incorporated into this EIS (the Watershed Analysis documents are available in the analysis files). Geotechnical analysis would occur prior to excavation. Further engineering analysis is needed at Mine Site D. Drainage at the mine sites and stockpile site would need further engineering design input. Roads have had detailed engineering input.

c. preparing road design criteria, elements and standards that govern construction and reconstruction

d. preparing operation and maintenance criteria that govern road operation, maintenance and management.

Project roads have specific design, operation and maintenance criterion based on engineering data and Best Management Practices. Road specifications are summarized in Chapter Two and detailed in the analysis files.

e. minimizing disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.

Roads constructed or improved for this project would use Best Management Practices and other criteria to minimize disruption of natural hydrological flow paths. Some diversion of stream flow could occur at the crossings, especially under the Proposed Action. Surface and subsurface flow may also be interrupted in all alternatives except Alternative 9 and No Action. See previous discussions in Chapter Four, and in the Physical Science report (Appendix F).

f. restricting sidecasting as necessary to prevent the introduction of sediment to streams

All roads would be designed to minimize sediment delivery into streams. See previous discussions in Chapter Four, and in the Physical Science report (Appendix F).

g. avoiding wetlands entirely with new road construction.

The Proposed Action would improve roads that pass near or across some small wetlands. Alternatives 6, 7, 8, 10 and 11 avoid some of the wetlands, but may have indirect impacts to small wet areas. No Action and Alternative 9 do not include any road work within wetlands. See Aquatic Conservation Strategy and other previous discussions, and the Physical Science report (Appendix F).

RF-3. *Determine the influence of each road on the Aquatic Conservation Strategy objectives through Watershed Analysis. Meet objectives by:*

a. reconstructing roads and associated drainage features that pose a substantial risk

The Proposed Action would have the greatest impact by using the two routes with the greatest sediment potential (road to Site D, Alberg Route). Alternatives 6 and 7 do not use the Alberg route, but would use the road to Site D. The road to Site D would be improved through reconstruction. Alternatives 8, 9, 10 and 11 avoid the road to Site D and the Alberg Route.

b. prioritizing reconstruction based on current and potential impact to riparian resources and the ecological value of the riparian resources affected.

The West Fork Illinois River Watershed Analysis recommended and prioritized restoration activities, including road projects, within the watershed. Road management objectives also address potential risks. Areas that have current sediment risk were discussed previously in this Chapter.

c. closing and stabilizing roads based on ongoing and potential effects to Aquatic Conservation Strategy objectives and considering short and long term transportation needs.

Road management objectives would close many roads within Riparian Reserves in the analysis area. These roads would only be maintained for mining access; traffic that is not part of an approved operating plan would be discouraged or eliminated. Once the roads are no longer needed for mining, they would be closed and treated. For roads that are included in an approved Plan of Operations, funding for final closures or other treatments would be borne by the miner. For roads not included in a Plan of Operations, final closures or other treatments would be part of the Forest Service regular watershed restoration program. These would be treated according to priorities established for the entire district. Annual stormproofing of mining roads (funded by the miner) would be required in all action alternatives prior to the wet season.

RF-4. *New culverts, bridges, and other stream crossings shall be constructed, and existing culverts, bridges and other crossings determined to pose a substantial risk to riparian conditions will be improved, to accommodate at least the 100-year flood, including associated bedload and debris. Priority for upgrading will be based on the potential impact and ecological value of the riparian resources affected. Crossings will be constructed and maintained to prevent the diversion of streamflow out of the channel and down the road in the event of crossing failure.*

All stream crossings would be designed to prevent diversion from stream flow out of the channel and down the road. In all action alternatives, no culverts would remain in place over the winter. Reconstruction of the Alberg Route may not fully meet this guideline, especially during high water when bankfull flow is exceeded.

RF-5. *Minimize sediment delivery from roads. Outsloping of the roadway is preferred, except in cases where outsloping would increase sediment delivery to streams, or where outsloping unfeasible or unsafe. Route road drainage away from potentially unstable channels, fills, and hillslopes.*

Alternatives 6, 7, 8, 10, and 11 would outslope or improve drainage on roads to minimize risk of sediment delivery. POC is also considered in this decision.

RF-6. *Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.*

The Proposed Action may retard the maintenance of fish passage during low flow conditions. All of the other alternatives are expected to maintain existing fish passage. The use of bridges (or avoiding stream crossings completely) would maintain fish passage during low flow conditions.

RF-7. *Develop and implement a Road Management Plan or a Transportation Management Plan to meet ACS objectives. At a minimum, the plan shall include provisions for the following activities:*

- a. inspections and maintenance during storm events*
- b. inspections and maintenance following storm events.*

All of the alternatives include stream crossings designed to withstand storms. Access will not be practical during the winter months in any alternative, except possibly under Alternative 11. Annual maintenance is required in the Proposed Action and Alternatives 6, 7, 8, 10 and 11. Road condition would be inspected prior to annual start-up for operations.

- c. road operations and maintenance, giving high priority to identifying and correcting road drainage problems that contribute to degrading riparian resources.*

Road construction, use, maintenance and improvement criteria has been established considering watershed conditions and hydrologic function. See previous discussions in this Chapter and in Chapter Two for details.

- d. traffic regulation during wet periods to prevent damage to riparian resources.*

All action alternatives would approve only dry season operation and road use.

e. *establish the purpose of each road by developing Road Management Objectives.*

Road Management Objectives have been developed for all roads (on National Forest) in the analysis area. Many of the roads would have objectives to close the road and eliminate traffic if they are not part of an approved mining Plan of Operations. Exceptions include the powerline road and the road to Mars swimming hole, that would likely remain open. The Road Management Objectives are part of the analysis files. Treatments needed to bring roads to their desired condition would occur under an approved operating plan or through the regular watershed analysis program.

Minerals Management

MM-1. *Require a reclamation plan, approved Plan of Operations, and reclamation bond for all minerals operations that include Riparian Reserves. Such plans and bonds must address the costs of removing facilities, equipment, and materials; recontouring disturbed areas to near pre-mining topography; isolating and neutralizing or removing toxic materials; salvage and replacement of topsoil; and seedbed preparation and revegetation to meet ACS objectives.*

A reclamation plan and bond would be required for the approved Plan of Operations (see Chapter Two). No mining would occur within Riparian Reserves.

MM-2. *Locate structures, support facilities, and roads outside Riparian Reserves. Where no alternative to siting facilities in Riparian Reserves exists, locate them in a way compatible with ACS objectives. Road construction will be kept to the minimum necessary for the approved mineral activity. Such roads will be constructed and maintained to meet roads management standards and to minimize damage to resources in the Riparian Reserve. When a road is no longer required for mineral or land management activities, it will be closed, obliterated, and stabilized.*

The Proposed Action and all of the action alternatives (except Alternative 9) include road development within Riparian Reserves. The impact of these roads on the Aquatic Conservation Strategy objectives is described elsewhere in this report. The Proposed Action would locate a stockpile site that is partially within the main stem Rough and Ready Creek Riparian Reserve. The other action alternatives would site this facility outside the Riparian Reserve.

Road development within Riparian Reserves is minimized in all action alternatives as compared to the Proposed Action (see chart under RF-2 above). The action alternatives would construct and maintain roads to meet roads management standards and minimize resource damage. The Proposed Action would clearly not meet this standard, because it includes several crossings and does not include specific design criteria to minimize resource damage. The Road Access Documentation Memo (available in the analysis file) describes criteria included for all action alternatives. Roads would be stormproofed annually under all action alternatives.

The roads would be closed to the public during mining operations in all action alternatives (the Proposed Action does not include provisions for road closures). When the mining operation is complete, many of the roads may be decommissioned, depending on whether they are required for future mining.

MM-3. *Prohibit solid and sanitary waste facilities within Riparian Reserves.*

Solid or sanitary waste facilities are not proposed within the Riparian Reserves.

MM-4. *For leasable minerals, prohibit surface occupancy within Riparian Reserves...*

Leasable mineral activities are not proposed in this project.

MM-5. *Salable mineral activities such as sand and gravel mining and extraction from Riparian Reserves will only occur if Aquatic Conservation Strategy (ACS) objectives can be met.*

Four potential rock sources exist within Rough and Ready Creek that may be suitable for road surfacing. Three of these sites are within Rough and Ready's Riparian Reserve on BLM lands. Removal of rock from these sites may require further analysis and would depend on the final selected alternative and the miner's preferences. Further analysis to assure that use of the rock would meet ACS objectives may be required. The Nicore IDT finds that use of the native rock would avoid introducing foreign material into the watershed and is likely better than using off-site rock. No rock sources have yet been proposed by the miner. Alternative 9 does not require this rock.

MM-6. *Include inspection and monitoring requirements in minerals plans, leases or permits. Evaluate the results of inspection and monitoring to effect the modification of mineral plans as needed to eliminate impacts that retard or prevent meeting ACS objectives.*

Environmental monitoring programs that meet the requirements of all permitting agencies would be implemented as part of any action alternative. Monitoring programs would be designed to quantify and measure environmental impacts accompanying construction, operation, reclamation and post-closure condition of the analysis area with reference to pre-operational data obtained during baseline monitoring. Impacts that result in violations of regulatory stipulations would require changes in the way the project is implemented, including additional mitigating measures. The proponent would be required to submit an annual report detailing monitoring data, interpretation and changes indicated by the monitoring results. However, if a regulatory threshold is exceeded, it must be brought to the attention of all appropriate agencies within 30-days (unless a shorter time frame is indicated through regulations, such as a hazardous substance spill). Monitoring would also be achieved through random or routine inspections by permitting agencies. Monitoring plans must be developed prior to final project approval and would be part of the final Plan of Operations. See Chapter Two for environmental elements that would require monitoring.

WILD AND SCENIC RIVER ELIGIBILITY - OUTSTANDINGLY REMARKABLE VALUES

The Outstandingly Remarkable Values (ORVs) associated with the main stem Rough and Ready Creek include Wildlife, and Geological/Hydrological, and Botanical/Ecological.

Wildlife - O'Brien Caddisfly

The O'Brien Caddisfly (*Rhyacophila colonus*) is a Forest Service sensitive species and was considered an Outstandingly Remarkable Value within the lower reaches of Rough and Ready Creek. Available records reveal *R. colonus* to be known from a single type locality. Four adult males and four adult females were collected by the Canadian F. Schmidt during a visit to the Illinois Valley (the general vicinity of O'Brien, Oregon - actual location unknown) in June of 1965. These specimens are presently located at the Institute of Entomology Research, Ministry of Agriculture in Ottawa, Canada.

R. colonus has not been located in the area since.

In 1996, The Nature Conservancy attempted to collect *R. colonus* on the lower reaches of Rough and Ready Creek using black light traps. *R. colonus* was not found in the traps. Specific habitat associations for the species have yet to be identified (larva of this genus are most commonly found in small to mid-sized streams in forested montane areas of the Pacific Northwest). Continued sampling for the species is occurring. The Proposed Action and Alternatives 6, 7, 8, 10 and 11 are associated with a “**May Impact**” finding for this species. No Action and Alternative 9 would have “**No Impact**”.

Geological/Hydrological

The unusual stream morphology (large substrate and wide alluvial fans) led to the identification of the Geological/Hydrological ORV on the main stem Rough and Ready Creek. The Proposed Action and all alternatives would protect this ORV.

Botanical/Ecological

The high number of rare plant species growing within one-quarter mile of the main stem Rough and Ready Creek led to the identification of the Botanical/Ecological ORV. The haul route in Sections 14 and 15 may disturb rare plants within the eligible creek corridor. Collaboration between the FS and the mine operator in road design and other possible mitigation would be necessary to adequately protect these plants. The Proposed Action and Alternatives 6 and 7 have the potential to degrade the Botanical ORV.

Scenic Classification

The maximum classification for Rough and Ready Creek in the vicinity of the creek crossings is *Scenic*. The multiple stream crossings under the Proposed Action and Alternative 7 may not maintain that classification. All of the other alternatives are likely to maintain that classification. Forest Service policy is to maintain the classification while a stream is studied for its Suitability as a Wild and Scenic River.

COSTS OF OPERATION

Operating cost estimates including road construction and reconstruction, crossing structures, costs of establishing and using a cable system, costs of helicopter sampling, dust abatement, gates, and ore haul via truck are disclosed below. The major components are fully described for each alternative in Chapter Two. A detailed spreadsheet listing costs for components of the Proposed Action and alternatives is in the analysis file. These costs do not reflect processing costs beyond getting ore to the stockpile site. These costs were used in the economic analysis that follows and the amount of ore that would be stockpiled varies between the alternatives. A summary of the data is presented in Figure 25.

	Alternatives							
	PA	NA	6	7	8	9	10	11
Total Road Construction and Reconstruction Costs (Thousands)	\$683	0	\$722	\$693	\$580	\$43	\$770	\$700
Cable Operation Initial Costs (Thousands)	0	0	0	0	0	0	\$1616	\$1616
Dust Abatement Costs (Thousands over Ten Years)	\$310	0	\$149	\$222	\$222	\$1	\$363	\$149
Gates (in Dollars)	0	0	\$2260	\$2260	\$2260	0	\$2260	\$2260
Haul Costs (Thousands)	\$2080	0	\$2800	\$2236	\$2127	\$840	\$870	\$970

Figure 25. Estimated Cost of Operation for Proposed Action and Alternatives

ECONOMIC VIABILITY

Substantial uncertainty exists relative to the economic viability of the proposed Plan of Operations. Two reports provided to the Forest Service examine the economics of the proposed Plan of Operations (Resource Strategies and Barrick). These reports state that the ore grades are at the extreme low end and the size of the ore body is far smaller than other similar ore bodies considered for commercial use. Barrick states that “There does not appear to be an economically attractive processing route to recover or market nickel products from the Oregon laterite ores...Oregon is an unsuitable location for downstream investment in stainless steel operations given its distance from both the product and scrap markets.”

No processes feasible for the production of nickel are known to be economical on the small scale proposed. Nickel is considered to be a sophisticated metal, particularly with respect to the industrial processes needed to extract it from its ores. Unlike gold, which can be mined and sold by individual operators with rudimentary equipment, the production and marketing of nickel is complex and capital intensive, with the result that only a few large corporations have so far succeeded in becoming profitable producers (Reimann, et.al. 1998).

Some new processes are becoming available for processing lower grade ore, such as that found at Nicore. The miner has stated that the ore would be processed with new, low-cost technology. However, even with new technology, the grade and size of the reserves are low compared to competing resources. Technology favorable for reducing processing costs would generally make operations with larger reserves and higher ore percentages even more favorable over the smaller, lower percentage ore bodies such as Nicore.

A project analysis was prepared by the Forest Service to evaluate the economics of the Proposed Action and alternatives. The results of the analysis are summarized here. Several assumptions and estimates were used to arrive at these figures:

1. Under the proposed action, 3.5 acres per year for ten years would be mined to a depth of 12 feet of which 50% would be usable after screening. This amount of material would produce 380 tons of nickel per year.
2. Smelting costs of nickel and other elements are \$2.25 per lb. This cost would actually vary depending upon the process used and the grade of ore present (Barrick, 1998).
3. Processing Costs of raw material is \$25/ton (Barrick, 1998).
4. Extraction and Transportation Costs are listed in the process record for each alternative, but generally exceed \$6/ton. Transportation costs beyond the stockpile site are assumed to be part of the processing costs.³⁴
5. The value of nickel and associated metals at Nicore is \$2.27 per pound on the world market. It is assumed that the making of stainless steel with nickel can be accomplished with ores throughout the world.
6. An internal rate of return is 4%. (This assumption is also conservative and is suggested by the Forest Service Economic and Social Analysis Handbook 1909.17, section 15.42-1.)
7. Inflation affects both the price of metals and the costs of production equally.

The Proposed Action and all of the action alternatives are associated with negative Present Net Values, suggesting that the full development may not be prudent, particularly at this time. All four proposed sites individually have a negative present value. This is mainly due to the production costs associated with nickel. Major changes in the world situation for nickel or in the technology for producing nickel would have to occur to alter the relative economic status of the Nicore project.

The benefit to cost ratios for each alternative were calculated. The costs exceed the benefits in all action alternatives. The sampling option has the lowest benefit to cost ratio, because it uses a helicopter to haul the ore. All other ratios for action alternatives are between 0.5 and 0.6. The most economically efficient alternative, measured by a benefit/cost ratio, is Alternative 11. These ratios would change as assumptions of values and costs of production change. No Action has a benefit to cost ratio of 0, which does not factor in the cost of maintaining the claims nor the cost of preparing the EIS.

³⁴There is no indication where the ore would ultimately be processed, thus speculation on transportation costs beyond the stockpile site is not meaningful.

The breakeven point (the price at which costs equal revenue) for the price of nickel and associated minerals such as cobalt and iron varies for the different alternatives. The Proposed Action's costs would equal its revenue if the world market reaches \$3.75/pound for the price of nickel and associated minerals. In contrast, Alternative 7's breakeven point is at \$4.02 per pound. The proponent would receive a reasonable rate of return for the investment on all alternatives if the price for nickel and associated minerals would reach \$5.54/pound. The highest price for nickel within the last five years was \$3.73/pound in 1995. However, as noted above, the price has fallen significantly to \$1.95/pound in August, 1998 (lowest in a decade) and long term trends are not expected to exceed \$3.00 per pound (Anaconda Nickel Limited 1998).

When the cost of the Environmental Impact Statement is factored into the analysis, the Present Net Value of all alternatives is decreased by approximately \$300,000, with a decrease in the benefit to cost ratio. The Present Net Value and Benefit to Cost Ratio for Alternative 9 are for the sampling only and do not include the costs or benefits of any future development.

	PA	No Action	6	7	8	9	10	11
Present Net Value (Millions)	-\$10.1	0	-\$10.6	-\$10.2	-\$9.5	-0.97	-\$9.0	-\$7.5
Benefit to Cost Ratio	0.58	n/a	0.57	0.57	0.57	0.10	0.55	0.59

The value of other resources in the proposed project area include (but are not limited to) the undeveloped (roadless) character, the botanical resource, the potential wild and scenic river resource, the water quality of Rough and Ready Creek and the fisheries resource. These resources are becoming increasingly scarce in the United States and consequently are increasing in value.

Economics is a study in relative scarcity, which allows comparison of monetary and non-monetary values. Clearly, the environmental qualities associated with the analysis area are scarcer at this point in time than the potential nickel. There are numerous readily available sources of nickel exploitation which offer considerably better economic scenarios.

EFFECTS ON RESIDENTS

Personal Values

In general, the project area is known for quiet and solitude for residents. The Proposed Action and all action alternatives have the potential to disrupt the quiet and reduce the quality of life for the people who live closest to the operation. Some people say they chose to live in this area because of the existing low ambient noise levels and limited traffic.

People who live within 100 feet of the haul route would suffer the greatest impacts (there are 4 homes within 100 feet of the Rough and Ready Creek Road used in Alternatives 6 and 11, and 22 homes within 100 feet of the Wimer Road that would be used in Alternative 10). Sixteen homes are within one-quarter mile of the haul route in Alternatives 6 and 11. The operation would likely be noticeable to those living further away, as well.

All legal requirements related to air quality, dust, noise and safety would be met. Each of the access scenarios is associated with loss of solitude for people living within several miles of the operation. Alternative 9 is associated with a shorter term, but more intense impact as ore samples are hauled out by helicopter. Helicopters would be required to stay a minimum of 1000 feet vertical distance and 1000 feet horizontal distance from any building not associated with the mining operation (unless the FAA requires a greater separation).

Dust and Air Quality

None of the alternatives would have significant impacts on air quality. Dust abatement would be used where needed to provide for safety, aesthetics, and local air quality impacts. Paving of the private road, and increased surfacing at other heavily used segments would decrease dust near residences.

The No Action alternative would continue the current situation. Dust is a problem for residents living on dirt or graveled roads. While some dust is generated on BLM and FS lands, the primary dust problem for residences is on private roads. Residents already put up signs requesting people drive slowly to minimize dust.

Tom Peterson, Oregon Department of Environmental Quality (see air quality update in the analysis file) confirmed that dust from this operation is not expected to pose health hazards. If needed, the beds of haul vehicles would be covered to eliminate ore blowing away. Dust abatement would also be required at the stockpile site. No Class I airsheds or population centers would be affected.

Noise

Current ambient noise levels in the vicinity of the haul route is low, estimated as 25 to 35 dBA. Sounds from the mining operation and ore haul are likely to raise these levels. The state of Oregon regulates noise generated from industrial operations and motor vehicles (OAR 340-35-030 and 035). All of the Action Alternatives would be required to meet state standards and mitigation described in Chapter Two would be required.

Figure 26 shows the number of homes within 100 feet of the haul route. These homes are subject to existing traffic and are well screened by vegetation. Some haul routes are further than 400 feet from any home. The closest mine site to any residence is Site C, within 0.5 miles. Mine Site B is on the ridge one mile above the closest residents.

The 1000 foot minimum can be increased if monitoring indicates noise levels are outside of compliance with DEQ regulatory standards. Figure 26 displays the factors that contribute to the noise assessment. Those alternatives that route trucks past homes or use the helicopter are most likely affect residents. Alternatives 6, 9, 10 and 11 fall within those categories. The Proposed Action (PA) and Alternatives 7 and 8 are less likely to affect residents relative to noise concerns. Alternatives 6 and 10 use smaller vehicles, which would be less noisy, but increases the number of trips. For all

alternatives, approximately 20% additional traffic may be expected from trips (personnel, administration, etc.) other than ore haul.

Alternative	Number of Houses within 100 feet of ore haul	Number of Round Trips	Helicopter Use
Proposed Action	0	3,390	No
6	4	5,700	No
7	0	3,390	No
8	0	3,150	No
9	0	670 for 120 hours flight time	Yes
10	22	3,100	No
11	4	1,940	No

Figure 26. Number of Homes within 100 feet of haul route, number of round trips, and helicopter use by Alternative.

Safety Issues

Safety issues would be greatest in the local area, particularly in O'Brien, where the haul route or flight path in all alternatives would come close to some residences. Current traffic is low and localized. Area youth frequent the swimming holes in the main stem of Rough and Ready Creek. Access to Mars swimming hole is near the haul route.

Helicopter operations also have inherent risks. A bucket of ore can break or spill. A person standing beneath the spill could be killed. Personnel working around helicopters are at greater risk than residents or the general public.

All of the action alternatives include mitigation to reduce user conflicts and safety hazards. Many regulations apply that reduce the risk of a tragic accident. Discouraging and restricting traffic and public use reduces some risk. Communications in ore haul vehicles (CB radios, for instance) would be desirable. The public would not be allowed within 1,000 feet of the flight path during helicopter operations. This is difficult to enforce and would require public cooperation.

Property Values

Assessed values of property are not expected to be significantly affected by the mine, despite the loss of personal value experienced by some people. The Josephine County Assessor's Office was consulted for information regarding property values (see Mendenhall Report in the analysis files). They agreed that the personal values of people who cherish solitude and living in a rural environment could be decreased by the mine site, but said that this shouldn't be confused with property values. Some people may move away because they do not like the effects of the mining, others may not buy property because of the mining operations, and others may not have strong preferences. The mining proposed for the next ten years would have the greatest effects on those living closest to the operations (see previous discussions about effects on residents, etc.).

Private road improvements contemplated in Alternatives 6 and 11 would likely lead to increased property values (see Mendenhall report), despite the loss of personal values (quiet, solitude) residents may experience.

A baseline for property values has been established through the Assessor's Office. For 1,101 parcels of land in T40S, R9 and R10W (excluding federal land), the average value for "vacant land" was \$19,999. The average value for the "improved land" was \$78,849. For 412 parcels in T40S, R9W, the average value for "vacant land" was \$19,495. The average value for the "improved land" was \$65,791. Values have tended to increase over recent years and that trend can be expected to continue, regardless of alternative chosen.

Trends in property values in neighboring Douglas County may provide relevant information regarding potential effects from Nicore (see Methany data, Mendenhall report). The actual property values for Riddle increased 10% just for 1997 (though, by the effect of a new law, they also decreased by nearly an equal amount). Overall property values in the Riddle area increased 60% from 1991 to 1996 (ibid.). Mining had been discontinued near Riddle, however the smelter there continued to operate.

Property values from 1982 through 1989, however, show a negative trend: values decreased 8% for residential properties smaller than 10 acres, and decreased 6% for properties larger than 10 acres but less than 40 (ibid.). Active mining occurred at Riddle during those years. The mine near Riddle is visible from Highway 5 and throughout the town.

Soda Springs, Idaho is another small town with an active mining operation. Preston Phelps of the Caribou County Assessor's Office stated that property values reflected an increasing trend over many years (ibid.), despite the presence of a mine. Between 1995 and 1999 property values increased 40% for seven residential properties priced from \$65,000 to \$125,000.

VISUAL QUALITY, RECREATION, and INTERPRETIVE DEVELOPMENT

Visual Quality

Visual quality would likely be reduced in the Proposed Action and all of the action alternatives. Road development and increased use would be evident to residents and visitors. Currently, the roads accessing the proposed mine sites are rarely used, and are generally not noticeable from the valley floor. Increased use would make the roads more visible, given dust plumes and noise drawing attention. Alternatives 7, 8, and 10 include new road construction that may be visible from several residences. The Bench Road included in these alternatives would be in the direct view of one or two residences. For FS lands, the Visual Quality Objective is modification. The level of development proposed in all action alternatives is consistent with this objective.

The location of the stockpile site would have a direct effect on visual quality. The Proposed Action includes a stockpile site that is near the highway and within the direct line of sight of an interpretive trail overlook proposed on the north side of Rough and Ready Creek. The site is within the ACEC where management activities may attract attention, but should not dominate the view of the casual observer (USDI 1995). The Proposed Action stockpile site would not meet this objective because it would tend to dominate the view from the interpretive trail.

The stockpile site proposed in Alternatives 6 through 11 would better meet this objective by locating the site away from the interpretive trail and the highway.

Recreation

Current use of the analysis area for recreation is generally low, except for the lower reaches of Rough and Ready Creek. The Botanical Wayside, ACEC, Mars Swimming Hole, Seats Dam, and the Siskiyou Meadows Youth Camp receive moderate use. Local residents enjoy horseback riding and hiking the existing roads. The No Action alternative would continue the current use. Development of the interpretive area is likely to increase users in the ACEC and Botanical Wayside.

The Proposed Action would increase motorized access on roads that are not currently driveable. Improving motorized access to currently inaccessible parts of the area would likely improve the recreational experience for some people and attract increased use.

Recreation traffic would likely increase, and with it, user conflicts. Road design criteria, including turn outs, would mitigate for some safety concerns given increased traffic. Increased traffic would be discouraged by placing gates at key locations in Alternatives 6 through 11. Hiking, biking, and horseback riding could still occur, and would result in some conflicts.

Alternative 10 would include access Mine Site B via the Wimer and Rock Creek Roads. The Wimer Road is a popular route that currently provides motorized access to the coast and dispersed recreation areas. The Rock Creek Road is not currently passable, but accesses the McGrew Trail, a driveable low-standard road. Increased conflicts are likely with use of this route. Road design would mitigate for safety concerns.

The estimated number of annual round trips with haul trucks is shown below. Approximately 20% additional traffic may be expected from incidental trips other than ore haul.

	PA	Alt 6	Alt 7	Alt 8	Alt 10	Alt 11
Annual Number Round Trips	3,390	5,700	3,390	3,150	3,100	1,940

Alternative 9 could impact a person's recreation experience while helicopter sampling was occurring. The area would be closed to public entry during operations as a safety precaution.

Interpretive Planning and Development

Highway 199 has been designated a Scenic Byway in Oregon and California. Both states include Rough and Ready Creek in its interpretive plans for the Byway. Mining and associated activities could degrade the views or experiences of travelers using the Byway. "Visitors who travel on Scenic Byways are looking for inspiration from natural wonders...a...mine may relay a poor image...and prompt visitors to continue on to portions of the Byway that express...preservation ethics" (Brandt Memo, February 1999). Members of the Illinois Valley Interpretive Planning Committee have expressed concern that the mine may threaten their efforts to attract tourism dollars (ibid.). Grant money available to develop interpretation of natural features on Scenic Byways could be lost if mining (and related traffic) were to degrade the experience of travelers (ibid.).

The Proposed Action stockpile site is also in direct view of an interpretive trail planned by the Oregon State Parks, BLM, Garden Club, Illinois Valley Community Response Team and other groups. The Alternative Stockpile Site (in Alternatives 6 through 11) would better screen the stockpile site, but ore haul and other activities may disturb users of the trail.

ROADLESS CHARACTER

All of the action alternatives (except 9) would improve roads and ore haul through the South Kalmiopsis Roadless Area and degrade the roadless character of the area (see Chapter Three for a description of Roadless Character). No Action and Alternative 9 would not increase access or the existing roadless character within the SK. The estimated amount of proposed road construction and miles of haul within the SK roadless area is displayed in Figure 27.

The maps in Chapter Two show the roadless area portion of the project. Currently several miles of low standard roads exist within the SK portion of the analysis area but access along the roads is limited by private land, road wash-outs and fallen logs, lack of road maintenance, and unmaintained creek crossings.

	NA	PA	Alt 6	Alt 7	Alt 8	Alt 9	Alt 10	Alt 11
Miles of Road Construction in SK	0	0.25	3.8	4.2	4.2	0	1.0	1.25
Estimated Miles Haul in SK	0	7.0	10.0	10.0	9.0	0	6.0	5.0

Figure 27. Road Construction and Miles of Haul within the SK portion of the analysis area.

The Proposed Action is associated with limited road construction in the SK but would not add road access to new areas. Road improvements would encourage increased traffic. Increased traffic would result in a loss of solitude and adverse effects such as noxious weed introduction, trash dumping, illegal activities, wildlife harassment, and other unintended consequences. Many people value to presence of a large roadless area near rural populations centers like Cave Junction. People have said they use the area for spiritual renewal and improving access or approving mining activities would harm their experience.

Alternatives 6, 7, and 8 would increase access along a ridge that currently is not accessible. Construction of four miles of road could lead to increased traffic and similar (or greater) effects as the Proposed Action. The ridge route is likely to remain part of the transportation network, at least until it is no longer needed for mining access. Some of the adverse effects would be mitigated by gating the area and restricting traffic to mining-related activities. The placement and strength of the gate are important factors in their effectiveness; people find ways to breach gates including physically removing the gate, breaking the lock, or finding an alternative path around the gate.

Alternative 10 improves access from the south and would result in potential effects to that part of the roadless area. Currently, the condition of the road limits access but there are no closures between the West Fork Illinois River and the top of the ridge (Mine Site B). The one mile route to the cable landing site (including in Alternative 10) would be closed following mining. It's effects could be minimized by mining Site D over a few seasons and then closing the road. Adverse effects would also be reduced by restricting the haul route to mining related traffic. As discussed previously, the effectiveness of gating roads varies.

Alternative 11 has less impact than the Proposed Action or Alternatives 6, 7,8 and 10 because it only improves a portion of the existing inaccessible routes.

Some people have expressed concerns that the “wilderness potential” of the SK may be compromised by the Plan of Operations, that there may be “irretrievable and irreversible consequences of developing any of the proposed mine sites or putting one blade to any road in the RARE II area (paraphrased from public comment).” Congress may designate a Wilderness in any area they choose. Wilderness character could be restored by closing the area to motorized traffic (earthen berms and ripping the entry of roads) and allowing natural recovery of the roads and mine sites. The scale of the operation proposed is not expected to result in an irretrievable loss of roadless character in the SK as a whole, or the Rough and Ready portion of the SK.

The hand of humans would continue to be evident in the area regardless of alternative (including No Action). The visual character of the area would take longest to recover in full scale mining alternatives (PA, 6, 7, 8, 10, 11). The current trend toward recovery would continue under Alternative 9 and No Action.

Cumulative Effects

Past mineral exploration within the watershed likely had significant effects on the roadless character of the area. No other developments are currently being considered within the SK. If the rest of the laterite deposits were mined, significant effects to the roadless character of the area are possible. Increased traffic and an extended, improved road system would be likely outcomes. The more disturbed by mining and road access, the less likely the area would be considered appropriate for Wilderness designation. The scale of the operation could be ten times the scale proposed in this EIS, which could lead to a irreversible loss of roadless character.

OTHER EFFECTS

Cultural Resources

A cultural resource survey did not indicate any historic, prehistoric, or cultural sites that might be adversely affected by this project. Sites or artifacts discovered at any time during operations would be reported to the Forest Archeologist.

Wildlife

Hundreds of vertebrate and thousands of invertebrate species may occur within the Nicore analysis area. The distribution and abundance of wildlife Species of Concern was described in the West Fork Illinois River Watershed Analysis (available upon request in the analysis file). The Proposed Action nor any of its alternatives are likely to adversely affect any PETS wildlife species, or critical habitat. Impacts to riparian areas and rock outcrops could result in adverse effects on individuals or groups of individuals (vertebrate and invertebrate species). These impacts are not likely to be serious or affect overall habitat conditions (based on the scale of the operation relative to unaffected habitat in the analysis area). No known migration routes (for species other than fish) would be affected. Noise and other disturbances related to mining activities may adversely impact individual animals but no effects on populations are expected given the overall scope of the operation.

Vegetation conditions were also discussed in the West Fork Illinois River Watershed Analysis. Although the action alternatives would remove some native vegetation, it is not expected to significantly degrade any late-successional or other special habitat, except as noted previously in this chapter.

Habitat for BLM sensitive species *Rana boylei* (yellow-legged frog) exists within the analysis area. Direct impacts to individual frogs or habitat are probable at stream crossings and other development in riparian reserves. The Proposed Action would have the largest impact, Alternative 9 and No Action would have no impact on this species. No significant effects on this species are expected in any alternative.³⁵

Habitat for *Plethodon elongatus* (del Norte salamander), a FS R6 and Survey and Manage Strategy 2 species, also occurs within the analysis area, but not in any areas that may be affected by mining. No impact on this species is expected.

Macro-invertebrate sampling revealed that total taxa (numbers of species) is relatively high in Rough and Ready Creek, ranging from 15 to over 45 species at any one sample site. Of particular interest is a distributional record of the mayfly species *Cleodes excogitatus*, the northernmost known record of this species and the first documented in Oregon. *Cleodes* was found in tributaries to Rough and Ready Creek.

Management Indicator Species

Forest management efforts consider all native vertebrate species. Several groups of species have special management needs. These groups include: (1) species dependent on specialized habitat conditions, such as cavity-nesters; (2) species requiring early, mature, or old-growth forest conditions for optimum habitat; (3) popular game species; and (4) endangered, threatened, and sensitive species.

The Siskiyou National Forest list includes: Bald Eagle, Osprey, Spotted Owl, Pileated Woodpecker, Pine Marten, Woodpeckers, Black-tailed deer, and Roosevelt Elk. The Proposed Action and/or Action Alternatives are not likely to significantly impact any Siskiyou National Forest Wildlife Management Indicator Species.

Survey and Manage Species (Wildlife)

The Survey and Manage (Wildlife) Standard and Guideline is intended to provide benefits to amphibians, mammals, mollusks, and arthropods. The Standard and Guideline contains four components, and priorities differ among them. These include: 1) Manage known sites, 2) Survey prior to ground-disturbing activities, 3) Extensive surveys, and 4) General regional surveys.

Preferred Alternative 9 would be designed to avoid all Survey and Manage Wildlife habitat. Further surveys would be required prior to implementation of any other action alternative.

³⁵Significant effects are defined as measurable effects that could lead to a reduction in overall population size and/or species distribution within the area.

Acid Mine Drainage

Some people have raised a concern that sulfides in the project area may result in ‘acid mine drainage’. No sulfides are known to occur within the project area (sulfides are not associated with peridotite or serpentinite), thus acid mine drainage is not likely.

Asbestos

The presence of asbestos in the project area has been the subject of some concern. Tremolite is a form of asbestos associated with serpentine rocks. It is not known or likely to be in the watershed, but the potential exists. If serpentine rocks were crushed for road surfacing, a human health hazard could result. The alternatives would not approve use of serpentine rocks for road work to avoid this possibility. Peridotite is not associated with tremolite and can be used without risk in regards to asbestos.

Artificial Lights

Artificial lighting is not a part of the Proposed Action, nor any alternatives. Artificial lighting would not be approved without an amendment to the final Plan of Operations and appropriate further analysis.

Fire Hazard

Some people have suggested that the project may increase the fire hazard in the area because of increased traffic and use of equipment. The operation would be required to follow Industrial Fire Precaution Levels for federal lands. The increased access associated with the action alternatives would increase the risk of human-caused fires and is likely to improve suppression capabilities in the area for lightning and human-caused fires.

Impact on the Wild and Scenic Illinois River

The Wild and Scenic River is over 10 miles from the analysis area. Effects from this action would be so diluted by other inputs on the river, no impact is anticipated. Other thresholds would be far exceeded before downstream Wild and Scenic river values would be affected.

Survey Monuments

No survey monuments are at risk of destruction in any alternative.

ISSUES THAT COULD NOT BE ANALYZED IN THIS EIS

This Action Should Not Be Analyzed Without a Smelting Facility Identified

The Responsible Official decided to analyze the project without a facility identified, but would not approve the final Plan of Operations until a smelting facility is identified and any additional environmental analysis needed is completed.

The 1872 Mining Law is Outdated

This issue is beyond the scope of project analysis. Concerns about the law cannot be resolved in this EIS. Chapter Four includes a section about conflicts between laws, policies, and plans.

The EIS Must Consider the Effects of the 4,000 acre Patent Application

The patent application is beyond the scope of this EIS. Some people believe the high acreage in the patent application indicates that the miner wishes to develop a much larger mine than disclosed at this time. The miner has indicated that should this operation prove successful, development of hundreds of acres accessed from the existing roads may follow. Laterite deposits have been mapped in the project area and are the basis for cumulative effects analysis (see Figure 13).

Were the existing roads authorized? Is the claimant's residence on BLM lands appropriate?

These issues are beyond the scope of this analysis. Documents about the original road construction are not maintained on the Siskiyou National Forest. Mining roads were likely constructed with little FS oversight. No evidence that the roads were built illegally exists. The miner's residence is an issue that would be addressed separately by the BLM.

POTENTIAL CONFLICTS WITH PLANS AND POLICIES OF OTHER JURISDICTIONS

Mining within this area poses conflicts between the mining laws and policies related to resource protection. For instance, all sensitive plants cannot be protected while allowing mining, road improvement and continued road use. Likewise, all aspects of the Aquatic Conservation Strategy and Riparian Reserve Standards and Guidelines cannot be met while approving a full scale Plan of Operations within the project area.

The Department of Environmental Quality is responsible for setting standards related to the Clean Water Act. Some of the components of the different alternatives may exceed some standards (particularly water temperature and nickel concentrations). Thus, some alternatives may not be permitted by the state.

The State Watermaster is responsible for allocating water rights. Some alternatives assume use of Rough and Ready Creek water, which is subject to water rights. The water right may not be granted and an alternative water source would be needed.

SPECIFICALLY REQUIRED DISCLOSURES

Relationship Between Short Term Use and Long Term Productivity

The analysis area is considered a low-productivity area in terms of total biomass production. Road construction and improvement would reduce the long term productivity along the haul route. This reduction would continue as long as the roads are being used, and perhaps beyond (roads in the analysis area do not tend to “reclaim” themselves). The mine pits themselves may not be restored to full productivity for decades or longer.

Consumer and Civil Rights

The project is unlikely to have significant effects on consumers or impact civil rights.

Farmlands, Wetlands, and Floodplains

No farmlands would be affected by this project. Impacts to wetlands are discussed under the Aquatic Conservation Strategy discussion previous in this chapter. The Proposed Action stockpile site is adjacent to a Rough and Ready Creek overflow channel that is visible on air photographs. The site is partly within the Riparian Reserve for the creek. However, the area is not on the federally mapped 100-year floodplain.

Socio-Economic

All of the action alternatives would create some employment. The road development would create one-time employment. The excavation and hauling of ore would provide increased long-term employment. The mining operation would also contribute to the tax base.

The mining could also reduce employment through indirect effects related to quality of life. The Josephine County Homebuilders Association, for example, oppose the mine partly on the basis that it could reduce the number of new homes people decide to build in the area. Fire Mountain Gems also suggested that businesses might leave the area if people did not want to live or work around an active mine. The Josephine County Homebuilders Association and Fire Mountain Gems letters are in the analysis files. Statements made by others at public hearings share similar concerns about how the mine's effects on quality of life could make the area less attractive to professions (such as doctors).

The Illinois Valley Community Response Team, and other groups interested in economic development, have endeavored to create opportunities for diversified industries that maintain steady employment and contribute to Quality of Life goals. Market driven cycles in "boom-and-bust" industries like mining can adversely affect economies of small towns.

Retirees may also choose to live elsewhere if their quality of life is adversely affected by operations on National Forest. The loss of wealth from retiree's could be more significant than the jobs created by the mining.

Irreversible and Irretrievable Commitment of Resources





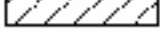




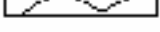
Minerals are considered a non-renewable resource. Vegetation in the vicinity of the pits would not likely fully recover despite reclamation. Roads are not usually considered an irretrievable commitment of resources, however, these roads are not likely to be reclaimed through usual means. The new bench and ridge roads, along with the existing routes, are likely to remain evident on the landscape for centuries to come.

Energy

The project, regardless of alternative, does not pose an unusual use of energy. The use of a helicopter for about 120 hours of operating time is not unusual to mining or other industries. The use of Jet A fuel is accepted under the laws of the nation.

NO ACTION EXISTING CONDITION

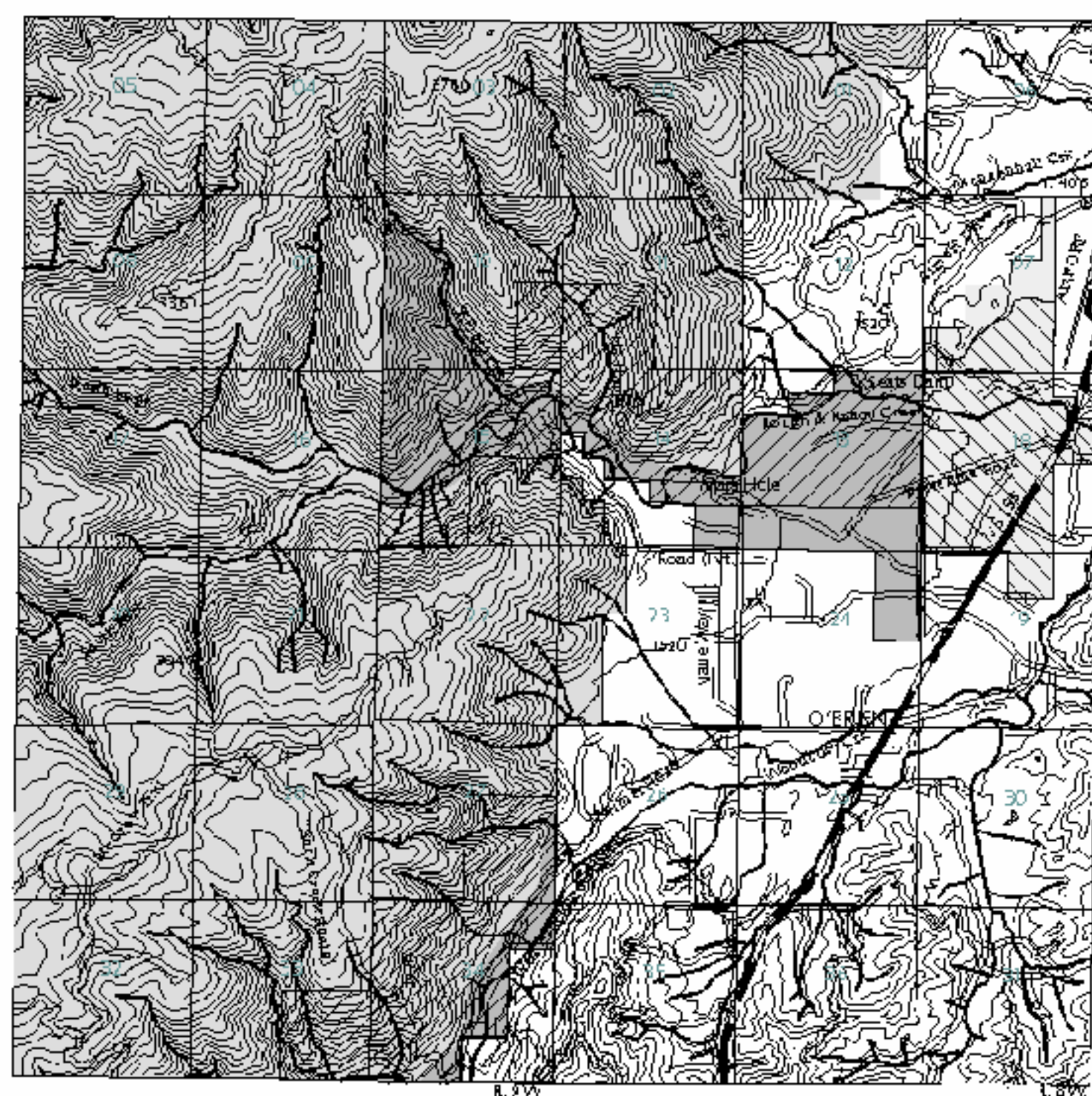
LEGEND

-  National Forest Lands
-  National Forest - Inventor Roadless Area
-  Bureau of Land Mgmt
-  State and Private Lands
-  USFS Botanical Area
-  ELM Area of Critical Environmental Concern
-  Streams
-  US 129
-  Existing Roads
-  Contour Lines

Scale: 1:53356






Figure 3



ALTERNATIVE 9 HELICOPTER SAMPLES

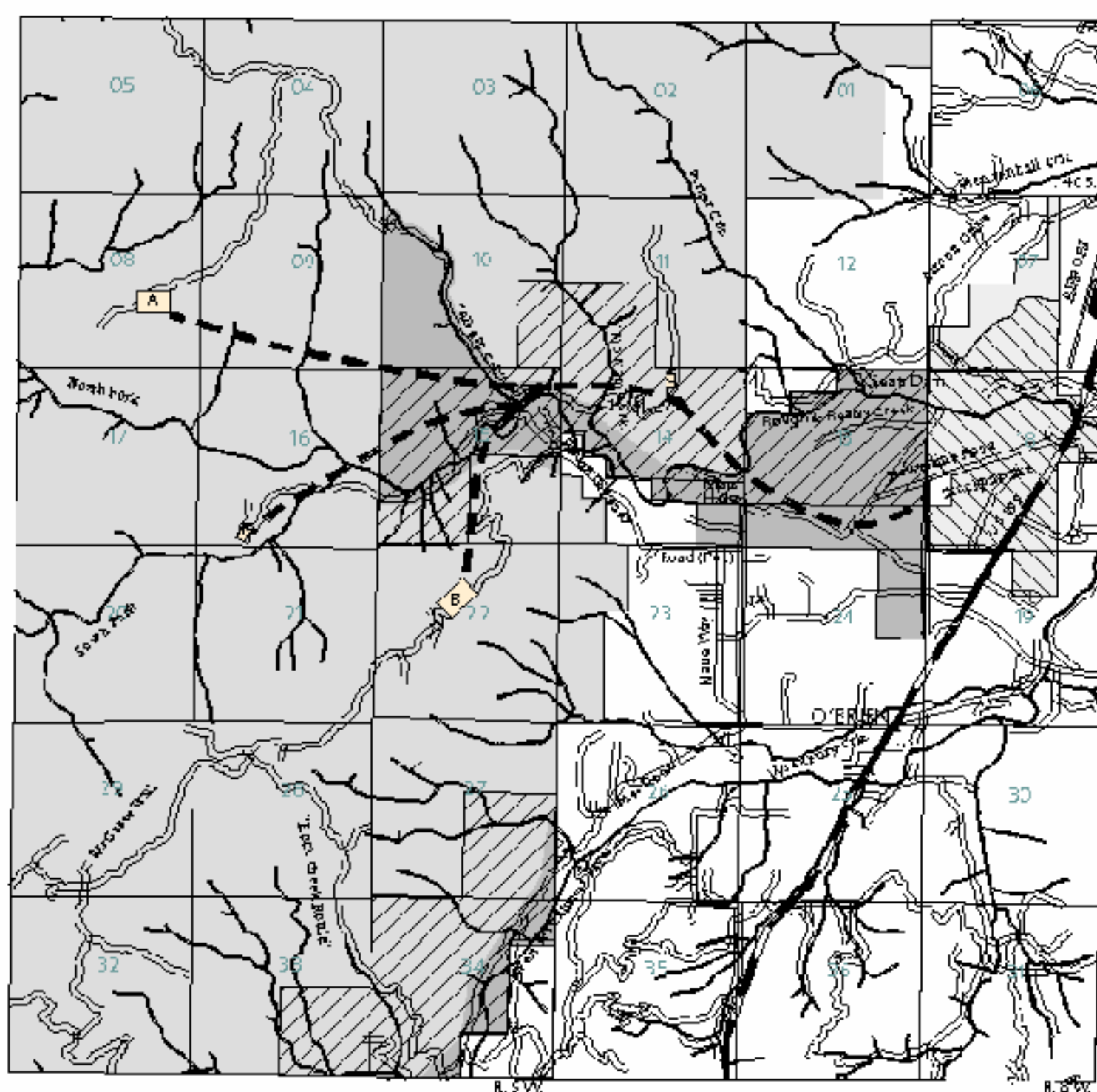
LEGEND

-  National Forest Lands
-  National Forest - Inventoried Roadless Area
-  Bureau of Land Mgmt
-  State and Private Lands
-  USFS Botanical Area
-  BLM Area of Critical Environmental Concern
-  Streams
-  US 199
-  Existing Roads
-  Flight Routes

Scale: 1:53355





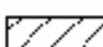







Figure 8



Nickel Bearing Laterites Mapped In Rough & Ready Area

LEGEND

-  National Forest Lands
-  Bureau of Land Mgmt
-  State and Private Lands
-  Latente Deposits
-  USFS Botanical Area
-  BLM Area of Critical Environmental Concern
-  Streams
-  US 159
-  Project Roads
-  Proposed Stream Crossing

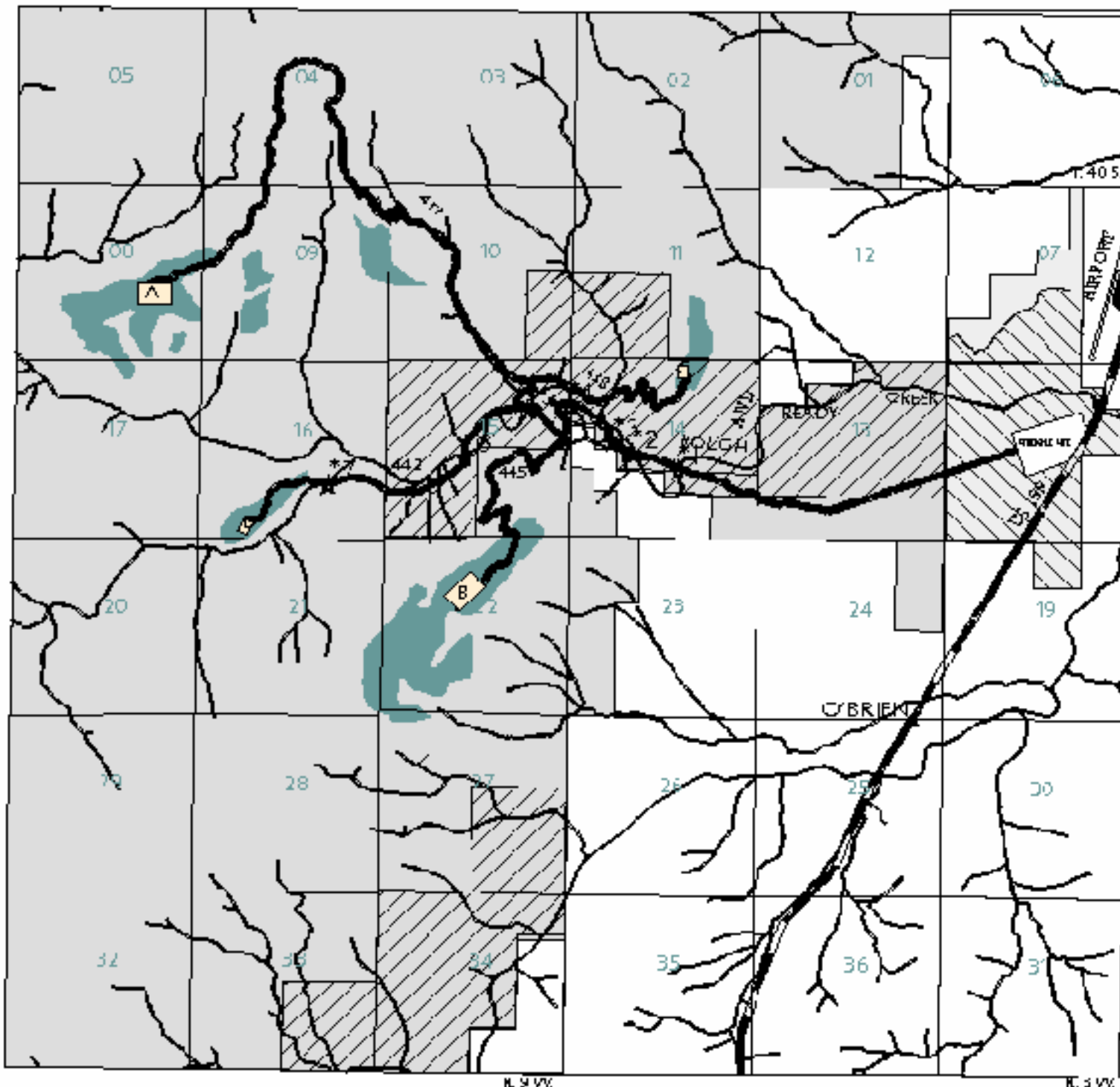
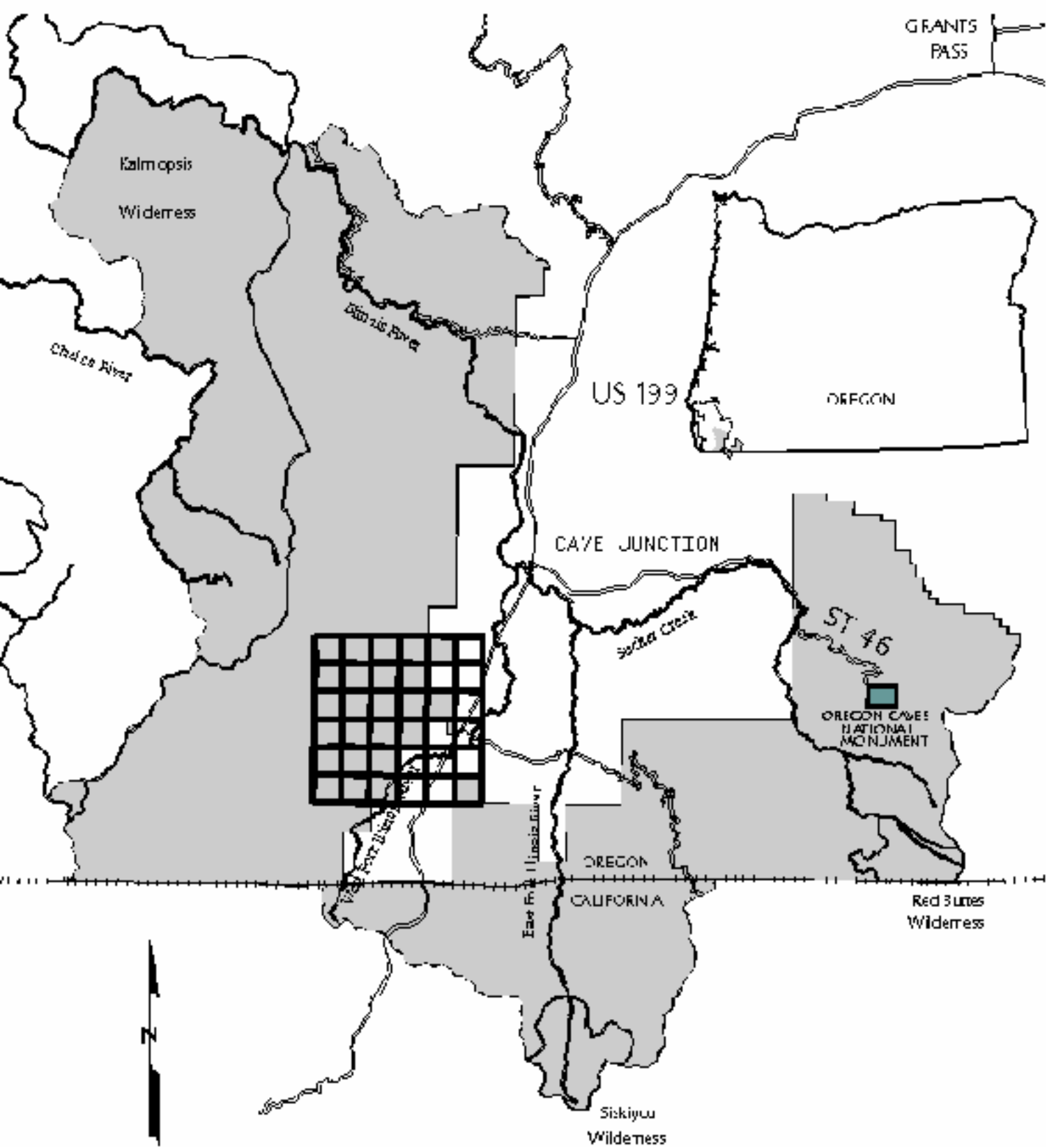


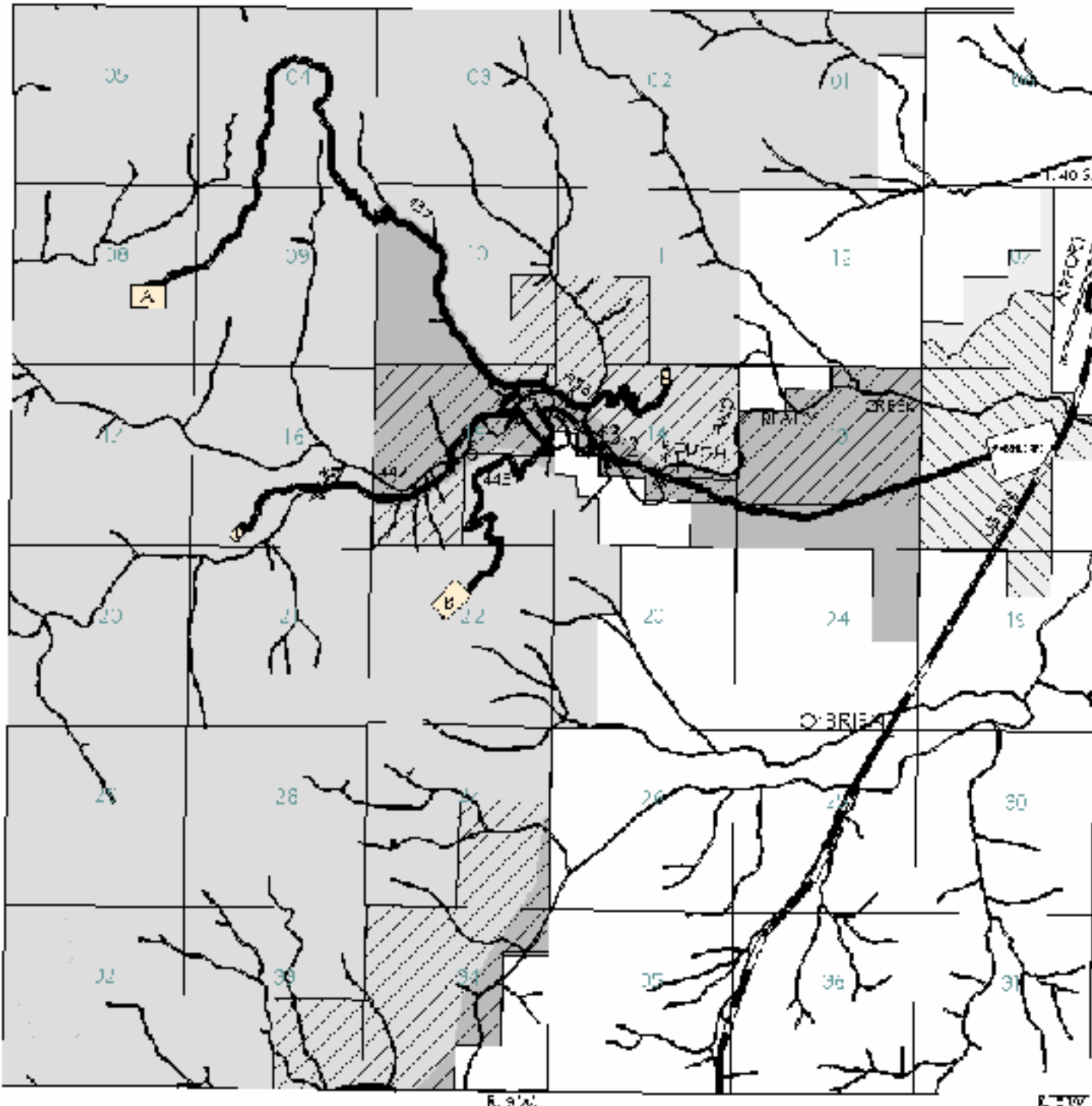
Figure 13

ILLINOIS VALLEY RANGER DISTRICT

Figure 1 Vicinity Map



PROPOSED ACTION



- LSCBND
- National Forest Lands
 - National Forest - Overlook Roadless Area
 - Bureau of Land Mgmt.
 - State and Private Lands
 - USFS Botanical Area
 - BLM Area of Critical Environmental Concern
 - Streams
 - US 199
 - Project Roads
 - Proposed Stream Crossing



Figure 2

ALTERNATIVE 8

No F. Site

LEGEND

-  National Forest Lands
-  National Forest - Inventoried Roadless Area
-  Bureau of Land Mgmt
-  State and Private Lands
-  USFS Botanical Area
-  BLM Area of Critical Environmental Concern
-  Streams
-  US 159
-  Project Roads
-  Proposed Stream Crossing

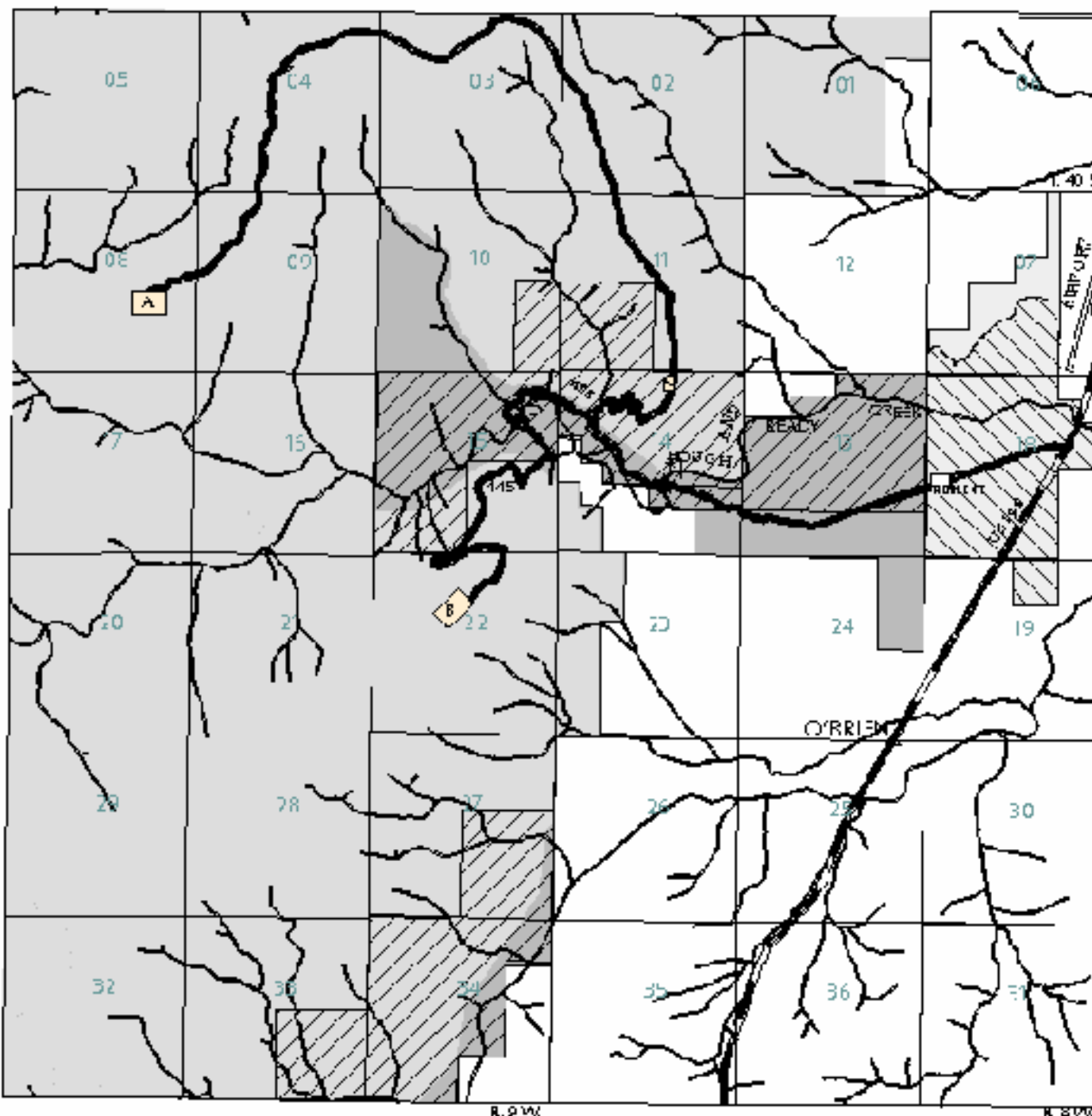


Figure 6

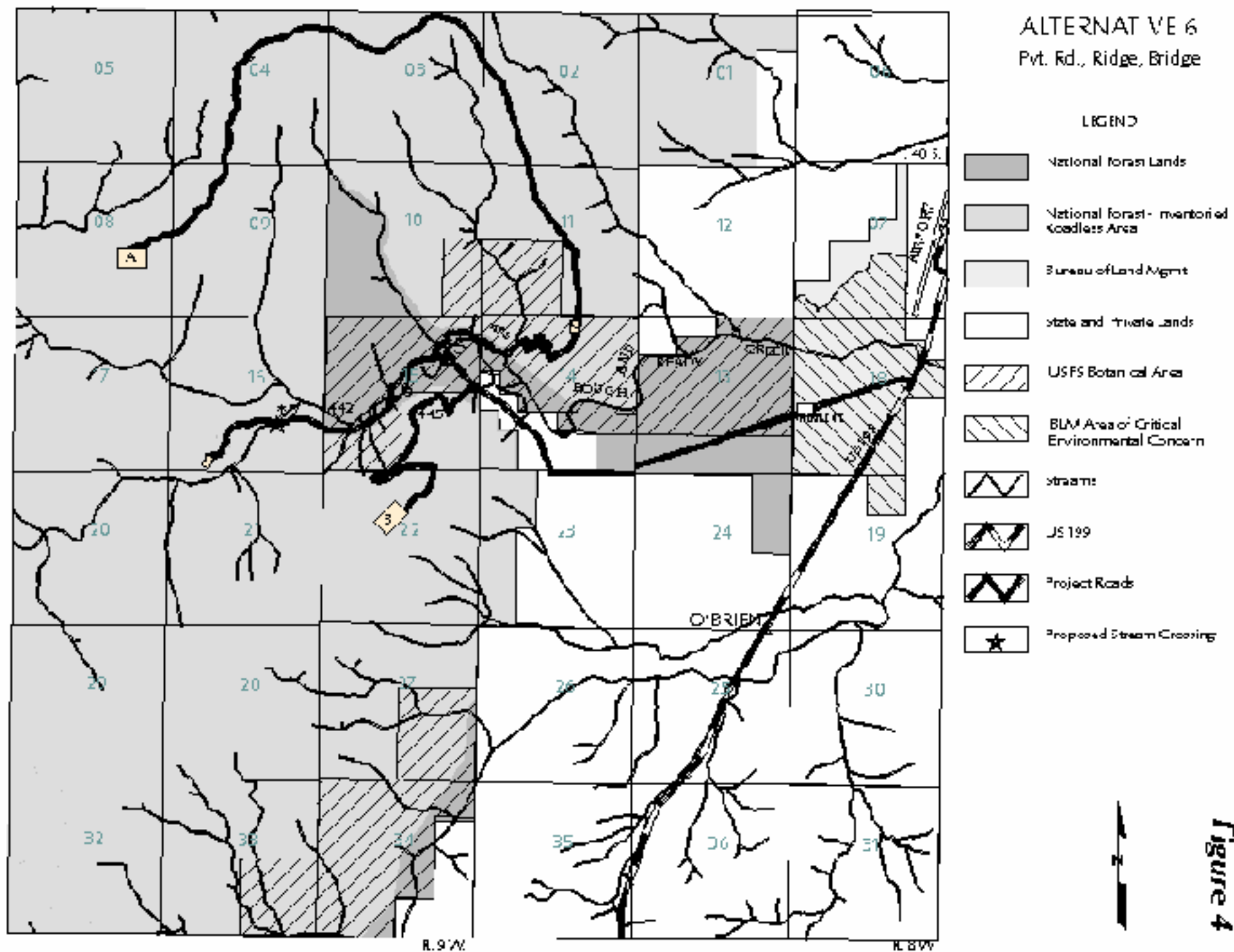


Figure 4

ALTERNATIVE / Bench, Ridge, Bridge

LEGEND

-  National Forest Lands
-  National Forest - Improved Roadless Area
-  Bureau of Land Mgmt
-  State and Private Lands
-  USFS Botanical Area
-  BLM Area of Critical Environmental Concern
-  Stream
-  US 199
-  Project Roads
-  Proposed Stream Crossing

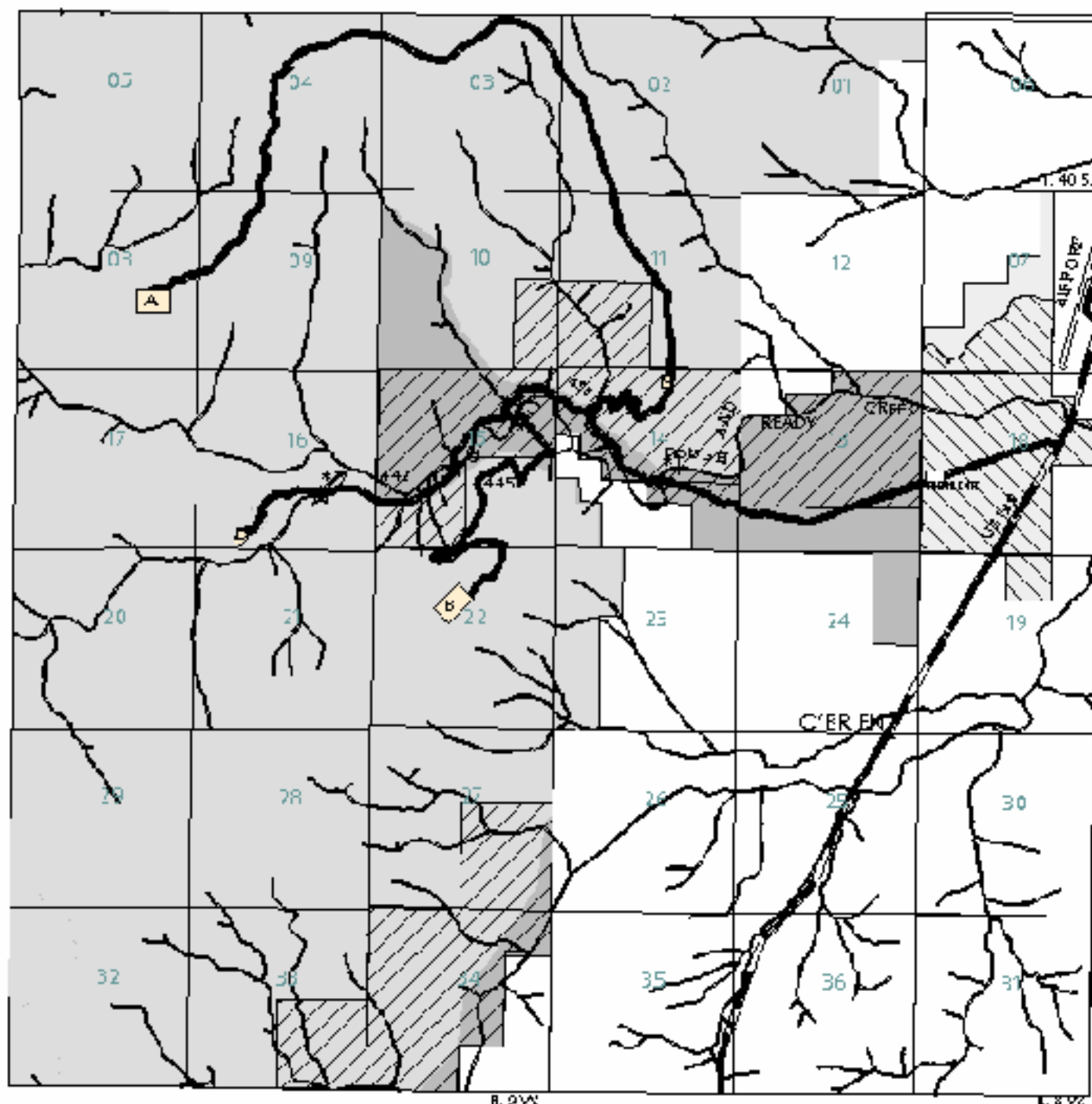


Figure 5